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A PHONOLOGICAL REANALYSIS OF EASTERN LAWA

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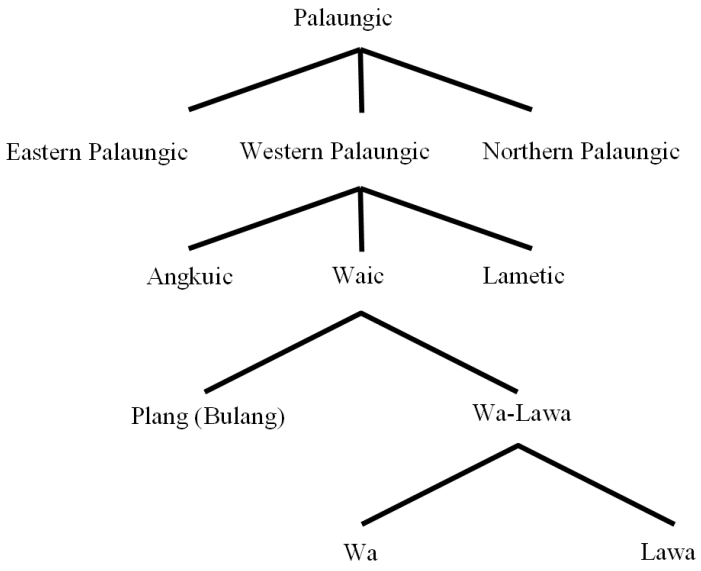
Abstract
Phonological descriptions of Western and Eastern Lawa, two related but mutually unintelligible languages (Nahhas, 2006), differ greatly. Western Lawa is relatively well described (c.f. Mitani, 1972, Schlatter, 1976, Ratanakul and Daoratanahongse, 1985). For Eastern Lawa, three partially conflicting phonological descriptions exist, with consonantal inventories ranging from 19 (Mitani, 1978) to 30 (Lipsius, n.d.) to 33 consonants (Blok, 2013). The vowel systems vary, from 9 (Mitani, 1978) to 24 (Blok, 2013) to 26 vowels (Lipsius, n.d.). In order to investigate the discrepancies between previous phonological descriptions, this study offers a phonological reanalysis of Eastern Lawa vowels and consonants based on recordings from nine Eastern Lawa speakers in Bo Luang and Kiu Lom, Thailand. A comparison with previous research on Eastern Lawa phonology suggests that the different results provided in earlier descriptions are partially caused by differing interpretations and partially due to undocumented phonological processes, which will be presented in this paper. Both synchronic and diachronic issues are considered.

Keywords: Eastern Lawa, phonology, Lawa, Waic
ISO 639-3 codes: lwl, lcp

1 Introduction
This study presents a reanalysis of the phonology of the Eastern Lawa language. It evaluates previous conflicting descriptions of Eastern Lawa and then presents a reanalysis based on newly-colllected data. Eastern Lawa and Western Lawa are the only members of the Lawa group within the Waic subgroup of the Austroasiatic Palaungic language group (Sidwell, 2015a). They are most closely related to the Wa languages (Sidwell, 2015a), as shown in Figure 1.

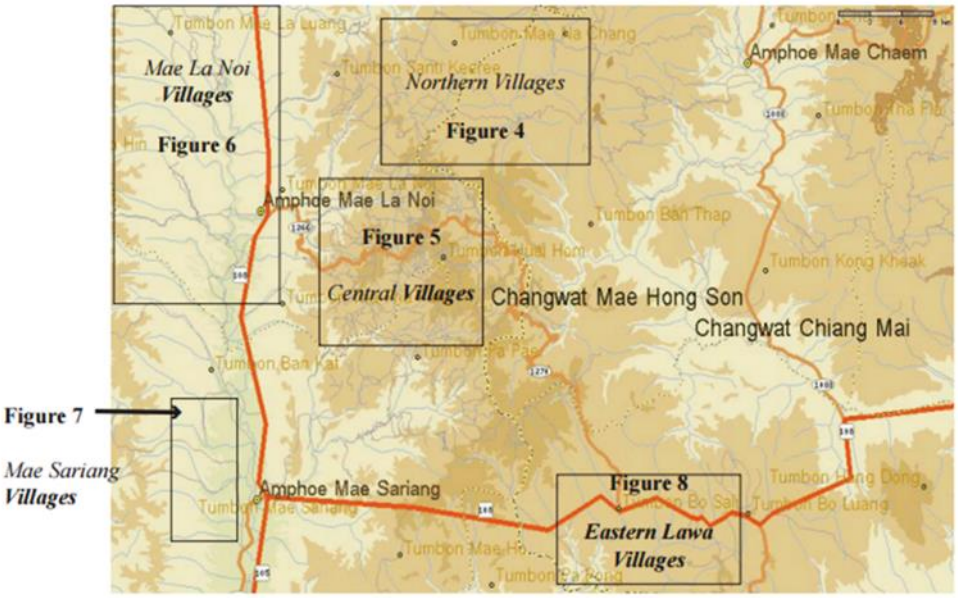
Figure 1: *Classification of Eastern Lawa (following Sidwell, 2015a)*



Eastern Lawa has about 7,000 speakers (Nahhas, 2006), and is located in northern Thailand, within Chiang Mai Province (Blok, 2013), as shown in Figure 2.

Within Eastern Lawa, two major varieties have been mentioned briefly by Lipsius (n.d.) and Blok (2013), labeled according to village names as Bo Luang and Bo Sangae (Blok, 2013).

Figure 2: *Location of Eastern Lawa villages and Western Lawa villages (Nahhas, 2006)*



To date there exist three conflicting phonological descriptions of Eastern Lawa. This paper will compare them and offer a new analysis, which will clarify those points on which the previous analyses disagree.

The Eastern Lawa recordings used for this study were collected from nine mother-tongue speakers in the fall of 2016 in Kiu Lom and Bo Luang, Hot District, Chiang Mai Province. These two villages speak the same variety. The language consultants available for this study included four men (two from Kiu Lom and two from Bo Luang) and five women (three from Kiu Lom and two from Bo Luang). Their ages ranged from 26 to 76. A 436-item wordlist with basic vocabulary was recorded from each speaker, and an additional 510 words were recorded from a 54-year-old female speaker from Kiu Lom. The wordlist was elicited in Central Thai. Each speaker was asked to repeat each word twice in isolation, then construct an utterance including the word, and then repeat the word once more in isolation. Data from all speakers was transcribed and analyzed, supported by the software programs Speech Analyzer and Phonology Assistant.

2 Previous research

Although Proto-Austroasiatic likely did not have register (Sidwell, 2015b), many Austroasiatic languages have since developed a register distinction, and register is now a characteristic feature of Austroasiatic languages (Huffman, 1976). The prototypical pathway by which register develops and may subsequently be lost in Austroasiatic languages is the so-called "Khmer model of registrogenesis" (Huffman, 1976). Registrogenesis is triggered by distinctive voiced and voiceless onsets (stage 1), with voiced onsets leading to breathy phonation of the following vowel and subsequent devoicing of the initial stops (stage 2). Former environmentally conditioned register phonologizes as as the voicing contrast in onsets is lost (stage 3). Finally, breathy or lax register gives way to diphthongization or tonality; phonemic register contrast is no longer present.

Different branches of the Austroasiatic family present variations on this central theme, but many have gone through this process in some form or other. The Katuic languages, for example, can be identified at various stages of this process: the most conservative, Katu, is still at stage 1, Souei (a Kuay variety) is at stage 2, and phonemic register (step 3) is found in several languages (Gehrmann, 2015). Some Katuic languages confirm Gregerson's (1976) observation of a general dispreference for tense close vowels and lax open vowels. Some varieties have only lax close vowels and tense open vowels, while others lowered tense close vowels and raised lax open vowels (Gehrmann, 2015).

According to Diffloth (1980), Proto-Waic was at step 1 in this registrogenetic process, with a series of voiced and voiceless initials. He suggests that after that, a Proto-Wa-Lawa group split off from the rest of the Waic languages as it merged the voiced and voiceless series, and developed a register contrast subsequently. From there, the Proto-Wa-Lawa group itself split up. Many Wa-Lawa varieties no longer have contrastive register today (Diffloth, 1980), and they vary widely in their present-day realizations of those proto-language register contrasts. For some varieties such as Wa, however, the register contrast has been retained (cf. Watkins, 2002). Proto-Lawa had its own particular set of conditions in which it developed diphthongization and replaced its register contrast with a vowel contrast between diphthongs and monophthongs:

> "The evolution of PW *a to PLw *ɨa looks very similar to what we saw in Drage's Wa, but the conditions for the appearance of diphthongization in Lawa are partly different from those of the Wa languages. These conditions have been discovered by Mitani (personal communication) and also apply to the Northern dialect which was not included in this survey; they are characteristic of the whole Lawa branch and no other branch of Waic."
> Diffloth (1980:46)

Proto-Wa-Lawa, with its register contrast, was in the diachronically unstable situation of having tense close vowels and lax open vowels, in contrast with the more natural lax close vowels and tense open vowels. After Proto-Lawa split off from Proto-Wa, Proto-Lawa vowel qualities shifted. Lax or breathy open vowels – in the case of Proto-Lawa, this was only *a̤ – developed significant raised onglides, leading to *i̤a. On the other hand, Proto-Lawa outcomes in respect of tense close vowels are more complicated, and vary depending on the variety of Lawa and the final consonant which follows (Diffloth, 1980). However, all varieties of Lawa have diphthongized only the tense close vowels, apparently not the lax ones, and in all cases, they have done so by lowering the first part of the vowel – for example, from Proto-Wa-Lawa *e to Proto-Lawa *ai (Diffloth, 1980), which has remained /ai/ in contemporary Western Lawa (Mitani, 1978).

Proto-Lawa, now with a rich vowel inventory including multiple diphthongs, split into Eastern and Western Lawa and from there into different sub-varieties (Mitani, 1978), with Western Lawa conservatively retaining most of those diphthongs, and Eastern Lawa simplifying many of them into monophthongs. In this process, many phones have vanished in one place only to resurface elsewhere. For example, Proto-Waic had a series of voiced stops /b, d, g/, which contrasted with its prenasalized stops /mb, nd, ŋg/ (Diffloth, 1980). The proto-voiced stop series devoiced in conjunction with the Proto-Wa-Lawa register split, but later on, the language developed voiced implosives /ɓ, ɗ/, replacing proto-forms *ʔm and *ʔr, *ʔl respectively. Contemporary Eastern Lawa, has two voiced stop series, just as its ancestor did – but modern /ɓ, ɗ/ do not correspond to *b, *d. Eastern Lawa today has the sequence [a^{i}h] or /aj̊/, just as Proto-Lawa did – but Proto-Lawa *a^{i}h became /i^{a}h/ in Eastern Lawa, while modern [a^{i}h] actually derives from *eh (Mitani, 1978).

2.1 Distinction between Western and Eastern Lawa

Much of the literature spoke of Lawa as a single unit, until a phonological analysis and comparison of one Eastern Lawa variety (Bo Luang) and three Western Lawa varieties (Umphai, La'oop, and Ban Phae) showed that the Bo Luang variety forms a separate group from the three Western Lawa varieties (Mitani, 1978). Western Lawa contains a great deal of diversity within itself – many aspects of the Umphai variety, for example, contrast sharply with the La'oop variety (Mitani, 1978). Because of this, it is difficult to make general statements that are true of all Western Lawa varieties. Only Western Lawa includes the phoneme /ˀl/; Eastern Lawa does not (Mitani, 1978), and the contrastive diphthong /a^{i}/ in Western Lawa is consistently predictable in Eastern Lawa. However, most of the differences between Western and Eastern Lawa can be found, not abstractly in the chart of phonemes, but in their lexical distributions (Mitani, 1978). When each language is taken as a whole, almost the same inventory of phonemes is found in Eastern and Western Lawa (Mitani, 1978). But looking more closely, the consonant and vowel distribution differs between the two languages, particularly within rhymes. For example, a word that is /pa^{u}n/ 'four' in every Western Lawa variety corresponds to /pɑ^{i}ŋ/ in Eastern Lawa. When compared, it is easy to see that Eastern Lawa has gone through a series of shifts that Western Lawa has not, and Western Lawa has gone through some shifts that Eastern Lawa has not.

Mitani's (1978) focus was to reconstruct a Proto-Lawa phonology, and he did not explicitly describe diagnostic features that can be used to distinguish Western and Eastern Lawa. However, his data show that

Western Lawa has been more conservative in general, while in Eastern Lawa, vowel qualities have shifted massively, proto-monophthongs as well as proto-diphthongs: Proto-Lawa *o is /ɔ/ in modern Eastern Lawa, *ə has become /ɛ/, *ɛ has become /iᵃ/, and so on. These vowel changes have taken place in specific environments, and furthermore, these vowel shifts often changed the final consonant following the vowel as well. This alteration of the final consonants happened frequently in Eastern Lawa, but quite rarely in Western Lawa. Mitani's (1978) data shows that, while Eastern and Western Lawa are equally conservative when it comes to initial consonants, nucleus-final combinations in Eastern Lawa have shifted almost twice as much as those in Western Lawa.

From a sociolinguistic perspective, there is no doubt that Eastern Lawa is distinct from Western Lawa, in that Eastern Lawa speakers cannot readily understand spoken Western Lawa (La'oop variety), and have little contact with any Western Lawa variety (Nahhas, 2006). Some Eastern Lawa speakers report that they rather use the national language (Thai) to communicate with Western Lawa speakers.

2.2 Previous studies on Eastern Lawa phonology and syllable structure

This section provides an overview of the findings on Eastern Lawa by Mitani (1978), Lipsius (n.d.), and Blok (2013), including findings from Blok's unpublished data. According to Mitani (1978), Eastern Lawa words may have up to four syllables, including minor syllables. Lipsius (n.d.) describes Eastern Lawa as mostly being monosyllabic, with disyllables carrying stress on the second syllable. Blok (2013) allows for words of up to three syllables, and notes that in most di- and trisyllabic words, the first syllable(s) are unstressed. Compounding is common for isolating languages and is attested by Mitani (1978) and Blok (2013). While Lipsius (n.d.) claims there is no derivation or inflection, Mitani (1978) and Blok (2013) provide examples of reduplication and prefixation, only differing in their transcriptions /piʔ/, /maʔ/, and /kaʔ/ (Blok) and /pi/, /mə/, and /kə/ (Mitani). Blok (2013) identifies /piʔ/ or /pi/ as a nominalizer, while this prefix is called 'person' by Mitani (1978). /maʔ/ or /mə/ indicates time, and /kaʔ/ or /kə/ indicates location (Mitani, 1978; Blok, 2013). The prefix /kuin/ has a diminutive function as in /kuin.ʔɛ/ 'chick', deriving from /ʔɛ/ 'chicken', and /kuin.sɔʔ/ 'puppy', deriving from /sɔʔ/ 'dog' (Blok, 2013). This prefix may be related to the word /ka.ⁿdɒwʔ/ 'child' according to Blok (2013).

Compared to Lipsius's (n.d.) inventory of 30 and Blok's (2013) inventory of 33 consonant phonemes, Mitani's (1978) consonant inventory is quite small, with 19 phonemes. Each study provides minimal pairs as justification for the phonemes they propose, which in the interest of brevity are not cited in this study. The reason is the interpretation of modified single consonants as sequences, such as Mitani's (1978) [ph] versus Blok's (2013) /pʰ/. Aspirated stops, preglottalized stops and nasals, prenasalized stops, and voiceless nasals are all interpreted as consonant sequencess in Mitani's (1978) analysis, and thus are absent from his chart of phonemes. Lipsius (n.d.) likewise interpreted voiceless nasals as consonant clusters. Mitani (1978) chose to transcribe [ᵐb, ⁿd, ᵑg] as /b, d, g/ respectively, and noted that these three phonemes are prenasalized everywhere, except when they precede a glottal stop. Mitani's (1978) small phoneme inventory, and the analysis of ambiguous consonant sequences as consonant clusters, results in a complex syllable template C(C)(C)V(V)(C)(C). Blok (2013) permits initial and final consonant clusters, C(C)V(V)(C)(C). Lipsius (n.d.) posits only single final consonants, C(C)V(V)(C).

Mitani (1978) and Lipsius (n.d.) use some non-IPA symbols in their analyses, which are represented with IPA symbols in the charts below, and throughout this paper: Mitani's /č/ and /ǰ/ represent voiceless and voiced palatal stops /c/ and /ɟ/ respectively; Lipsius's preglottalized nasals /ṁ, ṅ, ṅ/ are rendered as /ˀm, ˀn, ˀŋ/; Mitani's and Lipsius's palatal nasal /ñ/ is the equivalent of /ɲ/; and their palatal approximant /y/ appears as /j/ in this study. Likewise, /ˀj/ stands for Lipsius's preglottalized palatal approximant /ẏ/. Only consonant clusters which can reasonably be treated as single segments are included in Figure 3 below; unambiguous stop-liquid clusters such as [pl, kr], etc. are not retranscribed.

When ambiguous consonant sequences with voiceless glottal fricatives or glottal stops are interpreted as single voiceless or glottalized variants of the accompanying segments, the three previous descriptions differ very little. Mitani (1978), who postulates the smallest phoneme inventory, actually identifies two more phonemes than the other two studies, i.e. a voiceless palatal nasal /hɲ/ and a prenasalized palatal stop /ɲɟ/. Lipsius's (n.d.) analysis diverges from the others by including a palatal nasal, and another phoneme which he transcribes /ɲ/, described as a "voiced fricative/voiced prenasalized fricative", placed in the "palatal" column. Elsewhere in his analysis, he transcribes this palatal fricative as /ñj/ or /nj/. According to IPA standards, this phoneme will be transcribed below as /ⁿɟ/. Lipisus's (n.d.) /ɲ/ or / ñj/ or /nj/ likely corresponds to Mitani's

(1978) prenasalized palatal stop /ɲɟ/, but neither Mitani nor Lipsius give sufficient evidence for its phonemic status. Blok (2013) and Mitani (1978) identify final consonant clusters involving approximants /w, j/. Blok (2013) interprets some [VuC] as /VwC/, but interprets [ViC] as /ViC/, with the result that he lacks the syllable-final consonant clusters beginning with /j/ that Mitani (1978) shows.

Figure 3: *Eastern Lawa consonants according to Mitani (1978), Lipsius (n.d.), and Blok (2013)*

	Labial			Alveolar			Palatal			Velar			Glottal		
	M	**L**	**B**	**M**	**L**	**B**	**M**	**L**	**B**	**M**	**L**	**B**	**M**	**L**	**B**
Stop	p	p	p	t	t	t	c	c	c	k	k	k	ʔ	ʔ	ʔ
	ph	pʰ	pʰ	th	tʰ	tʰ		cʰ	cʰ	kh	kʰ	kʰ			
	ʔb	b	ˀb	ʔd	d	ˀd									
	b	ᵐb	ᵐb	d	ⁿd	ⁿd	ɲʄ			g	ᵑg	ᵑg			
Fricative	hw [f]	f	f	s	s	s		ʲj					h	h	h
		v													
Nasal	m	m	m	n	n	n	ɲ	ɲ	ɲ	ŋ	ŋ	ŋ			
	hm	hm	m̥	hn	hn	n̥	hɲ			hŋ	hŋ	ŋ̊			
	ʔm	ˀm	ˀm	ʔn	ˀn	ˀn				ʔŋ	ˀŋ	ˀŋ			
Rhotic				r	r	r									
					hr										
Approx-	w		w	l	l	l	j	j	j						
imant	wh		wh	hl	hl	l̥	jh								
							ʔj								
	wʔ		wʔ				jʔ	ˀj	ˀj						

Key: M – Mitani (1978); L – Lipsius (n.d.); B – Blok (2013)

Initial /f/ (Lipsius, n.d.; Blok, 2013) is interpreted as /hw/ by Mitani (1978). In syllable-final position, /wh/ and /wʔ/ (Mitani, 1978; Blok, 2013) as well as /jh/ and /jʔ/ (Mitani, 1978) have been posited. All three phonological descriptions show a syllable-initial preglottalized palatal approximant, but no labial-velar equivalent /ʔw/. Lipsius (n.d.) is unique in showing instances of a voiceless rhotic in his data.

With transcriptions adjusted to IPA and ambiguous consonant sequences interpreted as modified single consonant phonemes, the result of the three previous studies can be summarized as having three to four stop series with voiceless, aspirated, preglottalized voiced stops, and prenasalized stops. Nasals and approximants occur voiced, voiceless, and glottalized, with the latter feature not found for the lateral or the rhotic.

Figure 4: *Previously identified Eastern Lawa consonant phonemes in IPA transcription*

	Labial	Alveolar	Palatal	Velar	Glottal
Stop	p	t	c	k	ʔ
	pʰ	tʰ	cʰ	kʰ	
	ˀb	ˀd			
	ᵐb	ⁿd	ᶮʄ	ᵑg	
Fricative	f	s	ᶮj		h
Nasal	m	n	ɲ	ŋ	
	m̥	n̥	ɲ̊	ŋ̊	
	ˀm	ˀn		ˀŋ	
Approx.	w [v]	r l	j		
	w̥	r̥ l̥	j̊		
	wˀ		ˀj		

When excluding ambiguous consonant sequences, initial consonant clusters identified by Mitani (1978), Lipsius (n.d.), and Blok (2013) are reduced to /p, pʰ, ᵐb, t, k, kʰ, ᵑg/ followed by the liquids /r, l/. Blok (2013) has the largest array of initial clusters, with a few instances of /pʰl, kʰl, kw/ that are lacking in the other two analyses. Mitani (1978) lacks /pr, kr/.

Regarding the vowel inventory, Blok (2013) and Lipsius (n.d.) identify ten monophthongs. Their lexemes transcribed with /ɒ/ are rendered as /ə/ for a phonetic [ɒ] by Mitani (1978), whose analysis is otherwise identical.

Figure 5: *Previously identified Eastern Lawa monophthongs*

	Front	Central	Back
Close	i	ɨ	u
Close-mid	e	ə	o
Open-mid	ɛ		ɔ
Open		a	ɒ

Blok's (2013) 12 diphthongs are interpreted as vowel sequences by Lipsius (n.d.) and Mitani (1978). Blok also mentions the presence of triphthongs /uai/ and /iau/. These are not attested in his data, and are therefore ignored in the table below. Blok's (2013) /iu/ is suspicious as it occurs in Thai loans and only one Lawa word, /ʔasiu/ 'a little', rendered as /ʔəsiəʔ/ by Mitani (1978). Some of Blok's (2013) and Lipsius's (n.d.) diphthongs or vowel sequences are interpreted as vowel-approximant sequences /əy, ay, uy/ by Mitani (1978). These sequences are included in Figure 6 below.

Figure 6: *Previously identified Eastern Lawa diphthongs, triphthongs, and vowel sequences*

Target vowel distinction	**M**	**L**	**B**	**M**	**L**	**B**	**M**	**L**	**B**
Close front target vowel							uj	ui	ui
				əj	əi	əi	oj	oi	oi ~ ɔi
	ɛj	æi	ei	aj	ai	ai	ɔj	ɔi	
Close central target vowel	ɛɨ	æɨ		aɨ	aɨ	aɨ			
Close back target vowel			iu	əw					
	ɛw	æu		aw	au	au		ɒu	ɒu
Non-close target vowel	iə	iə		ɨə	ɨa	ɨa	uə	ua	
	eə	ia	iə ~ ia				oə	oa	uə ~ ua

Key: M – Mitani (1978); L – Lipsius (n.d.); B – Blok (2013)

In discussing the distribution of different vowel-consonant sequences in rimes, Mitani (1978) notes that /ə/, his phonological rendering of monophthong [ɒ] in full syllables and [ə] in minor syllables, does not combine with /yC/. However, he includes one word with this sequence, /gəyʔ/ 'pine'. This word is alternately transcribed by Blok (2013) as /ᵑgɛj/ or /ᵑkeʔ/. Lipsius's (n.d.) equivalent for Mitani's (1978) /əw/ is /ɒu/, while Blok (2013) alternately transcribes /ɒw, ɒ, ɔ, o/.

Mitani (1978) and Lipsius (n.d.) differ from Blok (2013) by distinguishing two front vowels with central offglides (/iə, eə/ according to Mitani, /iə, ia/ according to Lipsius) and two back vowels with central offlgides Mitani's /uə, oə/, Lipsius's /ua, oa/). Blok (2013) offers two non-contrastive variants for front vowels with central offglides with /iə/ or /ia/, and back vowels with central offglides as /uə/ or /ua/. Likewise, where Mitani (1978) and Lipsius (n.d.) distinguish between /oj ~ oi/ and /ɔj ~ ɔi/, Blok (2013) uses both transcriptions and finds no phonemic distinction between the two.

When ignoring the suspicious triphthongs, 10 monophthongs and 17 diphthongs have been identified for Eastern Lawa, shown in Figure 7.

Figure 7: *Previously identified Eastern Lawa vowel inventory*

	Front	Central	Back
Monophthongs:			
Close	i	ɨ	u
Close-mid	e	ə	o
Open-mid	ɛ		ɔ
Open		a	ɒ
Diphthongs:			
Close front target vowel			ui
		əi	oi
	ɛi	ai	ɔi
Close central target vowel	ɛɨ	aɨ	
Close back target vowel	iu	əu	
	ɛu	au	ɒu
Non-close target vowel	iə	ɨa	ua
	ia		oa

All previous studies agree on the monophthongs shown above. Even though Mitani (1978) does not list /ɒ/ as a phoneme, he indirectly includes it as the realization of /ə/ in full syllables. As for the diphthongs, there are more discrepancies. All researchers agree on an inventory with 14 diphthongs /ɛi, əi, ai, ui, oi, ɔi, aɨ, au, ɒu, iə, ia, ɨa, ua, oa/, although some analysed these as vowel sequences or vowel-approximant sequences rather than as diphthongs. Discrepancies include Lipsius's (n.d.) and Mitani's (1978) diphthongs /ia/ and /iə/ listed as free allophones by Blok (2013), /ɛɨ/ as posited by Lipsius and Mitani, and /əu/ as posited by Mitani.

3 Eastern Lawa phonological reanalysis

As shown in section 2, previous research shows discrepancies regarding the phonemic status of prenasalization, glottalization and nasal consonants, as well as the diphthong inventory. Based on the analysis of 946 lexical entries recorded for the study, 37 consonant phonemes and 16 vowel phonemes have been identified.

3.1 Eastern Lawa consonants

The consonant inventory differs from previous descriptions in that it includes /ɓ, ɗ, ʃ/ instead of /ˀb, ˀd, ˀj/. It lacks Mitani's (1978) /ⁿʒ/ and Lipsius' (n.d.) fricative /ⁿj/. The labial continuant /w/ is neither a bilabial approximant (Mitani 1978; Blok 2013) nor a labiodental fricative (Lipsius, n.d.), but varies from speaker to speaker with more or less stridency and involvement of the lower lip, [w ~ ʊ ~ v]. No instances of Mitani's (1978) /n̊/ or of Lipsius' (n.d.) /r̥/ could be found in this study. The equivalent of what has been presented as final consonant clusters /wh, wʔ, jh, jʔ/ (Blok, 2013; Mitani, 1978) has been confirmed. However, in this study, since no unambiguous final consonant clusters are found in Eastern Lawa, they are interpreted as voiceless and glottalized variants of the involved approximants, i.e. /w̥, wˀ, j̊, jˀ/ respectively.

Of the 37 consonants phonemes in Eastern Lawa, 33 may occur as onsets and 16 may occur as codas, with four of those, the voiceless and postglottalized approximants /w̥, j̊, wˀ, jˀ/, occurring only in the coda position.

Figure 8: *Eastern Lawa consonant phonemes*

	Labial			Alveolar			Palatal			Velar			Glottal
Oral stop	p	pʰ		t	tʰ		c	cʰ		k	kʰ		ʔ
Implosive	ɓ			ɗ			ʄ						
Prenasal. stop	ᵐb			ⁿd						ᵑg			
Nasal	m	m̥	ˀm	n	n̥	ˀn	ɲ			ŋ	ŋ̊	ˀŋ	
Fricative	f			s									h
Rhotic				r									
Approximant	w	w̥	wˀ	l	l̥		j	j̊	jˀ				

The coda inventory is reduced to voiceless oral and voiced nasal stops /p, t, c, k, ʔ, m, n, ɲ, ŋ/, the approximants /w, w̥, wˀ, j, j̊, jˀ/, and the glottal fricative /h/.

All identified initial consonant phonemes are shown in the following minimal and near-minimal sets:

Bilabial stop onsets:

/pɨᵃʔ/	‘father’
/pʰiᵊ/	‘to spin thread’
/ɓɨᵃʔ/	‘to break’
/ᵐbiᵊ/	‘to forget’

Alveolar stop onsets:

/tɛ/	‘sweet’
/tʰɔ/	‘that’
/dɛ/	‘forehead’
/ⁿdɛ/	‘horsefly’

Palatal stop onsets:

/cuᵃŋ/	‘foot’
/cʰuᵃŋ/	‘light (weight)’
/ʃuᵃŋ/	‘village’

Velar and glottal stop onsets:

/keh/	‘to give birth’
/kʰeʔ/	‘moon’
/ᵑgeʔ/	‘kindling’
/ʔeʔ/	‘we 1PL’

Bilabial nasal onsets:

/maw/	‘to crawl’
/m̥ew/	‘to play together’
/ˀmaw/	‘axe’

Alveolar nasal onsets:

/nɔŋ/	‘seed’
/n̥ɔŋ/	‘lake’
/ˀnɔŋ/	‘only’

Velar nasal onsets:

/ŋɔ/	‘fire’
/ŋ̊ɔʔ/	‘rice plant’
/ˀŋa/	‘twenty’

Alveolar-palatal-velar nasal onset contrast:

/nɔŋ/	‘seed’
/ɲoŋ/	‘lower back’
/ŋɔŋ/	‘knee’

Fricative onsets:

/fuᵃn/	‘to dance (>Thai)’
/suᵃk/	‘ear’
/huᵃk/	‘to climb’

Liquid onsets:

/roh/	‘to bark’
/lɔk/	‘correct’
/l̥ɔʔ/	‘bark’

Approximant onsets:

/wiᵊn/	‘mirror’
/jiᵊp/	‘to blink’

Minimal and near-minimal sets for all identified final consonant phonemes are shown below:

Final oral stops:

/ŋ̊ap/	‘to yawn’
/l̥at/	‘afraid’
/hac/	‘to scratch’
/hak/	‘skin’
/haʔ/	‘burnt’

Final nasal stops:

/n̥am/	‘blood’
/man/	‘what’
/moŋ/	‘word’
/moŋ/	‘gong’

Final approximants:

/pew/	‘to fly’
/pew̥/	‘to throw away’
/piᵃwʔ/	‘intestinal worm’
/kaj/	‘to have’
/taj̊/	‘mushroom’
/tajʔ/	‘arm’

Final fricative:

/kah/	‘to untie, unwrap’, in contrast with /kaj/ ‘to have’, /taj̊/ ‘mushroom’, /tajʔ/ ‘arm’

It is noteworthy that all three phonological studies mention preglottalized stops in Eastern Lawa. However, a closer look at the spectrograms and waveforms of items containing these phonemes reveals that they appear to be implosives. Voiced plosives display an initial increase in amplitude during the closure, which decreases before the onset of the following vowel, while implosives show a decrease in amplitude, indicating that larynx lowering inhibits the pressure buildup in the oral cavity (Ladefoged & Maddieson, 1996:84). The amplitude for implosives then rises before the vowel onset. Similarly, for tokens with the stops in question, the spectrogram shows the reduced amplitude during the closure with an increase in amplitude before the onset of the following vowel, typical for the implosives discussed by Ladefoged and Maddieson (1996). Waveforms and spectrograms for Eastern Lawa implosives are shown in Figures 9-11 below.

It has been suggested that the Proto-Palaungic language had implosive stops (Sidwell, 2015c). However, modern Eastern Lawa implosives are not derived from Proto-Palaungic implosives: the modern reflex of those implosives is voiceless aspirated stops (Sidwell, 2015c). These implosives instead derive from glottal-nasal and glottal-liquid sequences in Proto-Waic. Modern /ɗ/ derives from *ʔr, *ʔl, and, in one word, *ʔnr. Most words including modern /ʃ/ derive from *ʔɲ, although one, 'village', derives from *ʔj. The origin of /ɓ/ is less clear. Of the lexemes containing /ɓ/ identified in this study, only two were found in Diffloth's Proto-Wa-Lawa lexicon (1980), /s.ɓəŋ/ 'star' (*sʔmuŋ in Proto-Wa-Lawa) and /ɓew/ 'round' (*ʔmul/r). This suggests that /ɓ/ is a reflex of *ʔm; however, other instances of *ʔm in the Proto-Wa-Lawa lexicon remain /ˀm/ today, such as *ʔmo/ɨj 'axe', /ˀmaw/ today, and *ʔmoʔ 'rope', /ˀmoʔ/ today (Diffloth, 1980). However, although these implosives do not derive from Proto-Palaungic implosives, but rather from glottal-initial sequences, implosive stops have nonetheless resurfaced in Eastern Lawa.

Figure 9: *Waveform and spectrogram of /ʔ.ɓok/ 'pole', with cursors showing the location of /ɓ/*

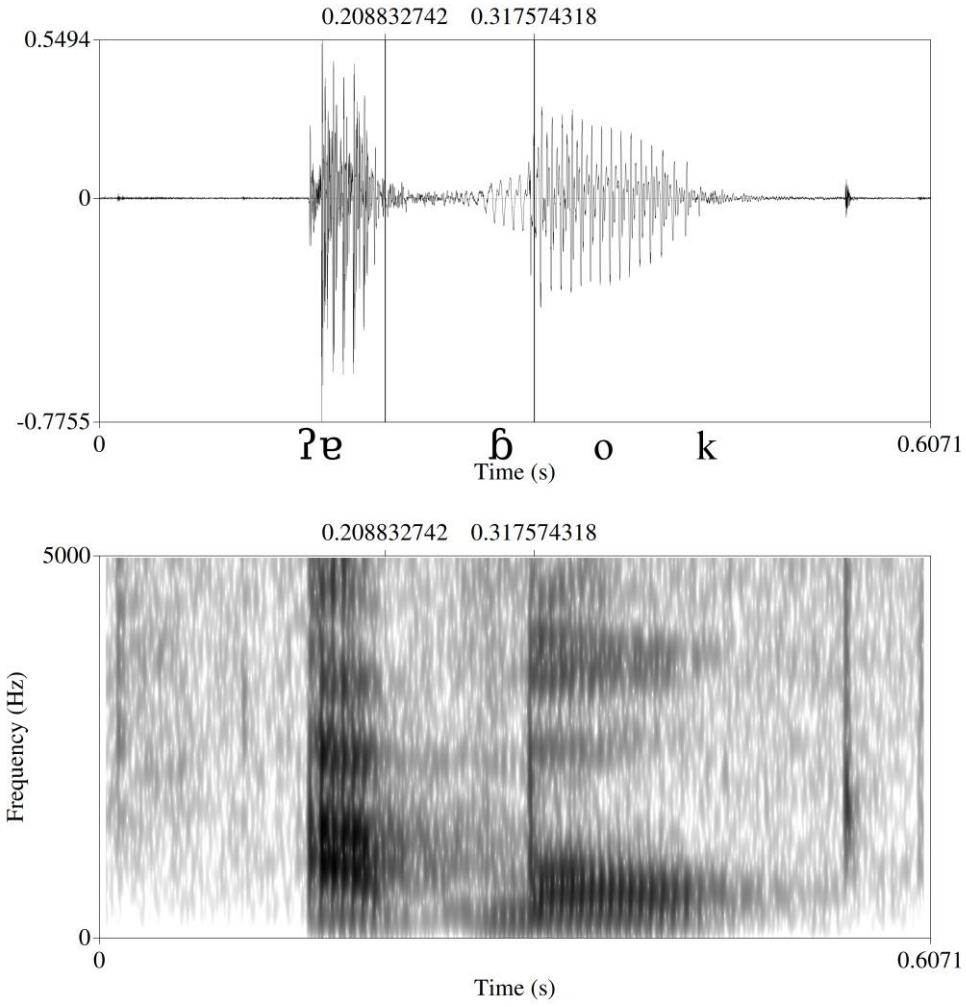
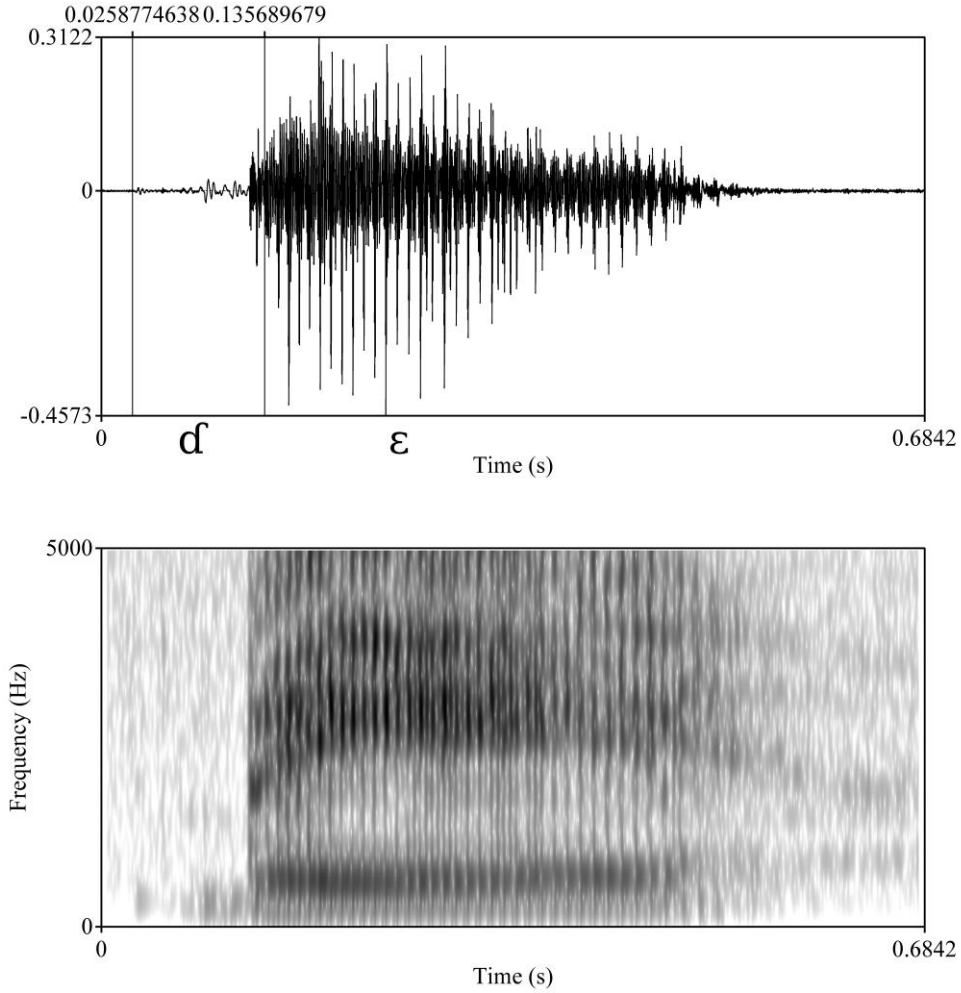
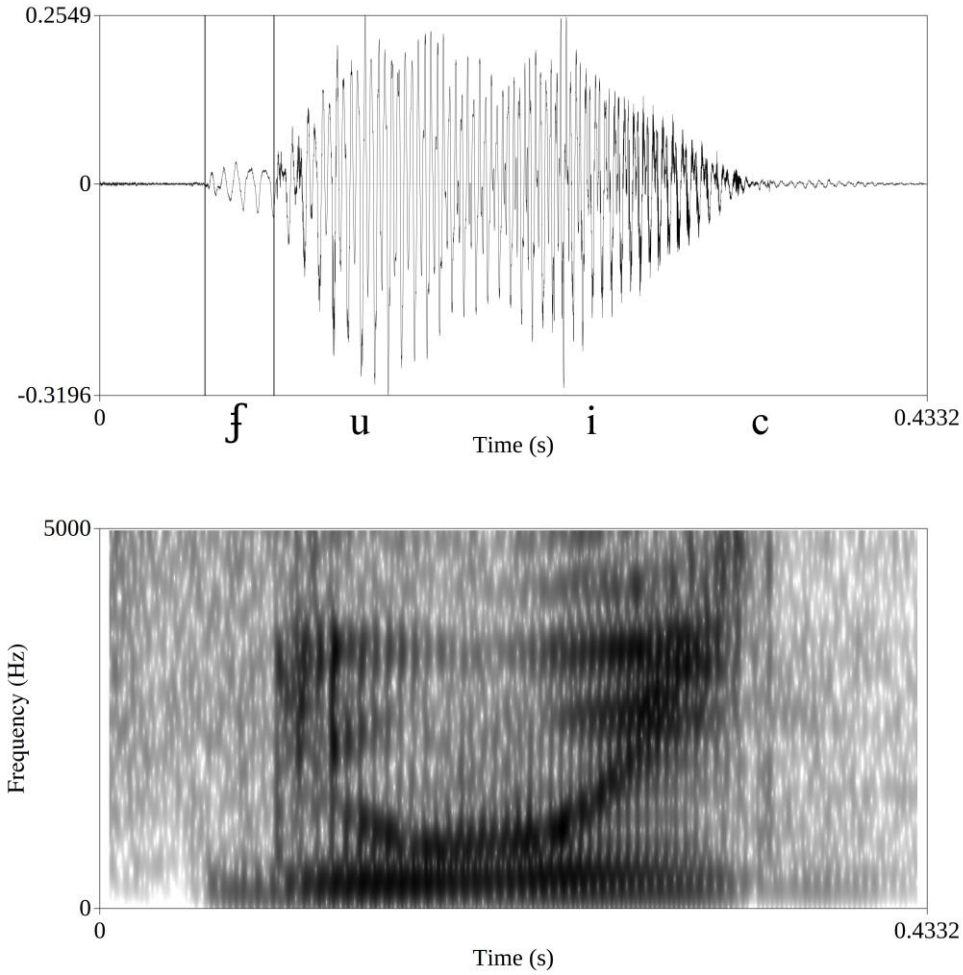


Figure 10: *Waveform and spectrogram of /dɛ/ 'forehead', with cursors showing the location of /d/*



This analysis differs from the earlier studies in its inclusion of the palatal implosive /ʃ/, which corresponds to Mitani's (1978) /ʔj/, Lipsius's (n.d.) /ˀj/, and Blok's (2013) /ˀj/. Although Mitani (1978) did not consider /ʔj/ to be a unit phoneme, he too recognized a plosive element in this sequence, as he notes that /j/ is realized as a voiced palatal affricate [dʒ] where it occurs before /ʔ/. An examination of spectrograms of items containing this phoneme reveals that it more closely resembles an implosive than an approximant, as shown in Figure 11 below.

Figure 11: *Waveform and spectrogram of /ʃuc/ [ʃuic] 'drunk', with cursors showing the location of /ʃ/*



However, even the simple approximant /j/ is more complex in its realization. Diffloth (1980) found that this phoneme was realized with a great deal of frication in all Lawa dialects, and /j/ was sometimes realized as preglottalized [ˀj] by the speakers interviewed for this study. However, even when preglottalized or produced with increased frication, the realization of /j/ was still starkly distinct from implosive /ʃ/, and the two are clearly contrastive.

3.2 Eastern Lawa vowels

Eastern Lawa has 16 vowel phonemes, comprised of ten monophthongs and six diphthongs.

Figure 12: *Eastern Lawa reanalysed vowels*

	Front	Mid	Back
Monophthongs	i	ɨ	u
	e	ə	o
	ɛ		ɔ
		a	ɒ
Diphthongs	iᵊ	ɨᵃ	uᵊ
	iᵃ		uᵃ
		aɨ	

The vowel /a/ is usually phonetically realized as the near-open central vowel [ɐ]. Unlike Mitani (1978), this analysis includes /ɒ/ as a phonemic monophthong. Otherwise, all monophthongs are identical to those of previous researchers.

Minimal and near-minimal sets for all monophthongs are the following:

Front vowels:

/kih/	'salt'
/keh/	'to give birth'
/kɛh/	'able'

Central vowels:

/dɨŋ/	'long'
/dəŋ/	'horn'
/ⁿdaŋ/	'pot (for cooking)'

Back vowels:

/ᵐbuŋ.ᵐbaŋ/	'butterfly'
/poŋ/	'bamboo shoot'
/pɔŋ/	'stairs'
/pɒŋ/	'window'
/paŋ/	'bottle'

Minimal and near-minimal sets for all diphthongs are shown below:

/tiᵊ/	'flower'
/tiᵃ/	'sarong'
/kuᵊt/	'old (person)'
/kuᵃt/	'cold'
/niᵃn/	'to look'
/nɨᵃŋ/	'often'
/nuᵃŋ/	'to harvest'

The reanalysis of Eastern Lawa diphthongs differs considerably from previous descriptions. All diphthongs and triphthongs which end in [i] or [u] have been eliminated due to predictable context-dependent behavior. As discussed below, the transitional close front vowel [i] is restricted to following final palatals, and the rounded back vowel transition [u] precedes only final labials.

This narrows the field considerably, but two issues still remain. Firstly, Lipsius (n.d.) and Mitani (1978) both show a vowel sequence which they label /æɨ/ and /ɛɨ/ respectively. The equivalent for this vowel in Blok (2013) and the present study is a mid-central monophthong /ə/. For example, the form for Lipsius's /sæɨ/ 'straight' in the present study is /sə/. Mitani's (1978) /səʔɛɨŋ/ 'snake' is /s.ʔəŋ/, and his /hmɛɨk/ 'to catch' is found to be /m̥ək/ in this study. Mitani (1978:17-18) argues that /ə/ has two allophones: [ə] in minor syllables and where it follows another vowel, and [ɑ] elsewhere. If Mitani's (1978) [ɑ] is the equivalent of Lipsius's (n.d.) and Blok's (2013) /ɒ/, this explains why Mitani did not identify [ɒ] as a phoneme like they did – where Blok finds /ə/ and /ɒ/ to be contrastive, Mitani represents the same contrast by transcribing /ɛɨ/ and /ə/ respectively. Since Lipsius (n.d.) gives so few example words and does not include a word list, it is unclear how his three-way distinction of /æɨ/, /ə/, and /ɒ/ corresponds to Blok's (2013) and Mitani's (1978) two-way distinction. It is a mystery how Mitani (1978) and Lipsius (n.d.) can clearly identify and agree on this /ɛɨ/ or /æɨ/ sequence, and yet today, Blok (2013) and I find no trace of it. Mitani's (1978) analysis of Proto-Lawa shows that his contemporary /ɛɨ/ derives from Proto-Lawa *əɨ and *əw, so it would seem more straightforward for *əɨ and *əw to simply reduce to a modern /ə/, rather than change to /ɛɨ/.

Secondly, both Lipsius (n.d.) and Mitani (1978) make distinctions between two front diphthongs and two back diphthongs. Lipsius (n.d.) labels them /iə, ia/ and /ua, oa/ respectively, while Mitani (1978) labels them /iə, eə/ and /uə, oə/. Blok (2013) identifies just one phonemic front diphthong, which may be realized as either /iə/ or /ia/ and is transcribed both ways in his research, and one phonemic back diphthong, which likewise may be either /uə/ or /ua/. The present research confirms Lipsius's (n.d.) and Mitani's (1978) analysis: contrary

to Blok (2013), Eastern Lawa does distinguish two front diphthongs and two back diphthongs, here transcribed /iə, ia/ and /uə, ua/ respectively. These are attested by several sets of minimal pairs: /piᵊŋ/ 'tooth' and /piᵃŋ/ 'expensive', /tiᵊ/ 'flower' and /tiᵃ/ 'sarong', /kuᵊt/ 'old' and /kuᵃt/ 'cold', /muᵊn/ 'fun' and /muᵃn/ 'pillow'.

3.1 Phonological processes

All vowel sequences ending in [i], such as [ai, ei, ɔi, ui] etc., occur in only two environments, i.e. preceding final palatal and glottal final consonants [c, ɲ, h, ʔ]. Regarding palatal oral and nasal stops, the vowel [i] appears as a predictable transition, so that no vowels sequence ending in [i] is contrastive in this environment. The [i]-transition is not found in any other environment.

$$V \rightarrow V\text{-}i\text{-} \,/\, \_\_\ C_{[palatal]}$$

As for these vowel sequences followed by [h, ʔ], it seems more plausible to interpret V-[ih] as the voiceless approximant /Vj̊/ and V-[iʔ] as the postglottalized approximant /Vjˀ/. Thus, Eastern Lawa contains no true diphthongs ending in [i]. In addition, there are no contrastive diphthongs found preceding palatal finals. The reason may be that, as a result of this [i]-transition, this would lead to phonetic triphthongs, which Eastern Lawa does not allow for.

There is likewise a transitional [u] preceding final labials as well as voiceless glottal fricatives and stops [p, m, h, ʔ] in Eastern Lawa. This transitional vowel [u] is also found with the diphthong /aⁱ/; when it appears before a final labial, the offglide becomes rounded. Thus, /naⁱm/ 'to urinate' is realized [naum].
some insertion of [u] before final labials in Eastern Lawa, but it behaves quite differently from [i]-insertion before palatals. These vowel sequences ending in [u] could only be followed by [p, m, h, ʔ], but insertion of [u] is restricted to the mid front vowels [e, ɛ], i.e. /tɛm/ [tɛum] 'to boil', /mep/ [meup] 'cow'.

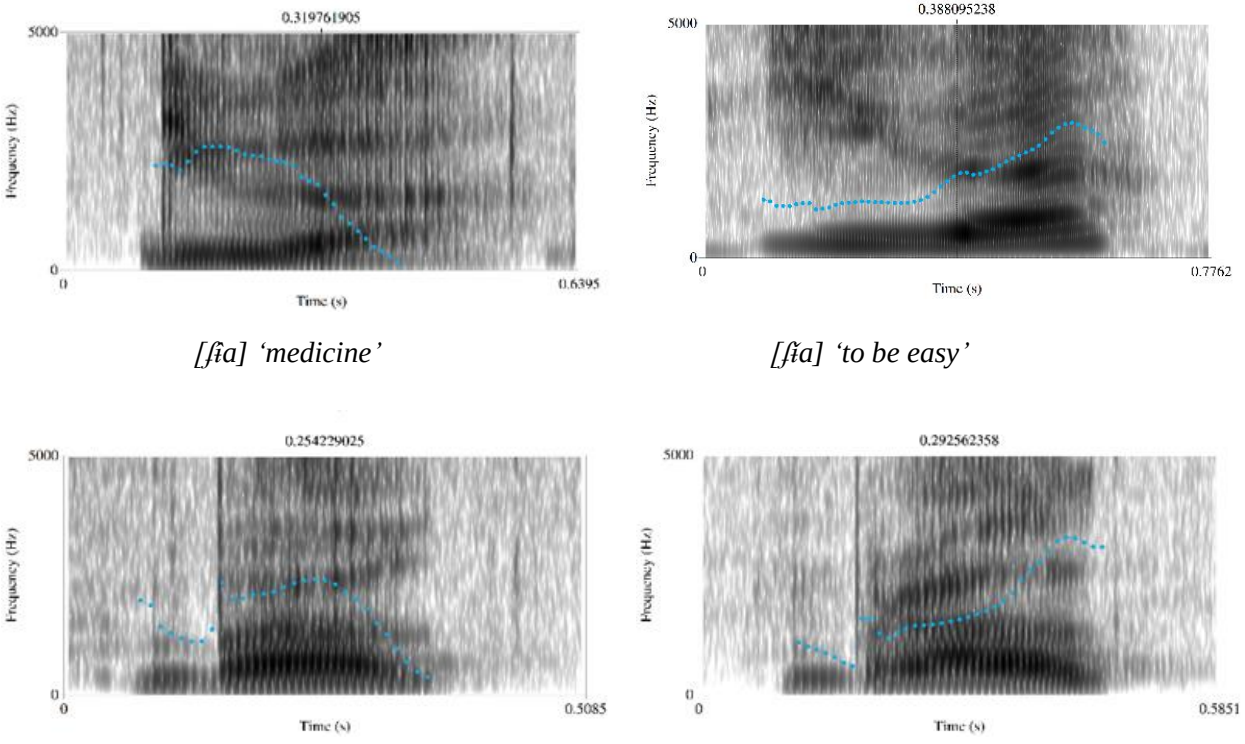
$$V_{[mid\ front]} \rightarrow V_{[mid\ front]}\text{-}u\text{-} \,/\, \_\_\ C_{[bilabial]}$$
$$a^{i} \rightarrow au \,/\, \_\_\ C_{[bilabial]}$$

This vowel transition is missing for some loanwords from Central or Northern Thai: /him/ 'next to, beside', /lot.tʰip/ 'bicycle'. Mid and back monophthongs and all diphthongs may appear before final labials, in which case, [u] is simply not inserted: /n̥am/ 'blood', /ʔ.pum/ 'fence', /tɔm/ 'liver', /jɨᵃm/ 'to cry', /ciᵃp/ 'to wink'.

3.2 Noun and verb pitch in isolated tokens

Eastern Lawa displays a pitch distinction between nouns and verbs when uttered in isolation (Mitani, 1978). Nouns are pronounced with level or falling pitch, and verbs have a high or rising pitch. Whereas Mitani (1978) noted this difference for nouns and stative verbs, this study finds that any verb is produced with high or rising pitch. This is demonstrated in Figure 13 below. In connected speech, this pitch distinction is less clear, probably because the verb-noun distinction can be inferred from context. However, more study using consistent carrier phrases is needed in order to evaluate whether this phenomenon is found only in single utterances. No other minimal pairs distinguished by pitch have been identified in this study, so Eastern Lawa is not a tonal language. However, these pitch patterns clearly distinguish nouns and verbs in isolation, reflecting a possible quasi-lexicalization of tone in this environment. They are not an artifact of the recording process, since Eastern Lawa speakers are able to identify words in isolation which are otherwise homophones based on this pitch pattern. Even though the spectrograms for the noun tokens with falling pitch show individual glottal pulses toward the end of the vowel, indicating creaky voice, no evidence of contrastive register was found in Eastern Lawa.

Figure 13: *Auto pitch graphs of noun-verb homophones*



[ɟia] 'medicine' *[ɟia] 'to be easy'*

[ᵐbrâk] 'chili' *[ᵐbrǎk] 'to swallow'*

4 Word and syllable structure

Eastern Lawa is an isolating language with four derivational prefixes. It displays mono- and sesquisyllabic syllable structure, and makes extensive use of compounding and reduplication. Derivational prefixes include /pi/, /ma/, and /ka/ (cf. Mitani 1978; Blok 2013). The prefix /pi/ acts as a nominalizer. It most frequently derives agents, as in /pi.ʔ.pəŋ/ 'woman' derived from /ʔ.pəŋ/ 'female', /pi.cʰoʔ.toʔ/ 'butcher' derived from /cʰoʔ/ 'to sell' and /toʔ/ 'meat', and /pi.s.ⁿdajˀ.ɲiᵃʔ/ 'neighbor' derived from /s.ⁿdajˀ/ 'near' and /ɲiᵃʔ/ 'house'. /pi/ also nominalizes verbs or adjectives, as in /pi.puᵃn/ 'food' derived from /puᵃn/ 'to eat', and /pi.nɛm/ 'truth' derived from /nɛm/ 'true'. This prefix may have derived from /puj/ 'person', and which can still be seen in some cases; the word for 'adult' appears both as /puj.rɨʔ/ and /pi.riʔ/, where /rɨʔ/ means 'big'.

The prefix /ma/ meaning 'time' is seen in the words /ma.saʔ/ 'morning', /ma.pu/ 'evening', and /ma.saⁱm/ 'night'. This may have derived from the Northern Thai /mɨa/ 'when', but more study is needed to confirm this. Another prefix, /mu/, means 'plural', as in /mu.meʔ/ 'you (plural)' and /mu.tʰɔ/ 'they'. This may likewise have derived from Northern Thai /mu/ 'group'. The prefix /ka/ indicating location is seen in the words /ka.hej/ 'here', /ka.saj̊/ 'below, south', and /ka.dûᵃŋ/ 'above, north'.

Compound words, which are common, contain up to four syllables. The word for 'moth', /ᵐbuŋ.ᵐbaŋ.ma.saⁱm/, combines /ᵐbuŋ.ᵐbaŋ/ 'butterfly' and /ma.saⁱm/ 'night'. /kuᵊn.tiŋ.kuᵊn.ʔiᵊn/ 'cousin' combines /kuᵊn/ 'child', /tiŋ/ 'older sibling of parent', and /ʔiᵊn/ 'younger brother of father'. There are only two five-syllable compounds in Eastern Lawa, 'east' and 'west'. /la.ka.ʔɔk.s.ŋajˀ/ 'east' combines /la.ka/ 'direction', /ʔɔk/ 'to go out, exit', and /s.ŋajˀ/ 'sun'. 'West' /la.ka.liᵊk.s.ŋajˀ/ combines /la.ka/, /liᵊk/ 'to enter', and /s.ŋajˀ/ again.

The basic word structure for Eastern Lawa is both monosyllabic and sesquisyllabic. The template for the word in Eastern Lawa is (c).C(C)V(C). All possible combinations allowed under this template appear in Eastern Lawa. Examples of all syllable types are given in the following words:

CV	/pɛ/	'mango'
CCV	/kɾa/	'to hunt'
CVC	/fiᵃk/	'dark'
CCVC	/kʰɾɔŋ/	'slit'

c.CV /p.tiᵊt/ ‘to jump’
c.CCV /t.kɾaʲ/ ‘to fall over’
c.VC /c.ɾaj/ ‘angry’
c.CCVC /ʔ.prɔ̊j/ ‘to shiver, tremble’

The vowel in the minor syllable is fully predictable and thus is not required in phonological transcription. Phonetically, the vowel in minor syllables varies depending on its environment. It is slightly raised when it follows /s/, as in /s.puj/ [sə.puj] ‘eggplant’. When it appears between two palatal consonants, as in /c.caʔ/ ‘ghost’, it is realized as [i], and in the word /p.mə̯ew/ ‘friend’ it is realized as [u] due to influence from the surrounding labial consonants. In all other environments, it is realized as [ɐ]. Eastern Lawa also contains some compound words composed of two full syllables with contrastive vowels. They are distinguished from sesquisyllables by the duration and quality of the vowel, which therefore is transcribed in these words.

The consonant inventory for minor syllables is reduced to eleven phonemes: unaspirated stops with an exceptional bilabial and palatal stop which can also occur aspirated, furthermore, fricative /s/, nasal /m/ and the two liquids. Only three examples of aspirated stops in minor syllables are found in the data, two of which are loanwords: /cʰ.moŋ/ ‘hour (Thai)’, /pʰ.sa/ ‘language (Thai)’, and /pʰ.mat/ ‘to insult, offend’. Thus, the status of aspirated stops in minor syllables is questionable. The appearance of minor syllables may be related to the general pattern of initial syllables having decreased vowel length in sesquisyllabic words.

Figure 14: *Consonant inventory for minor syllables*

	Labial	Alveolar	Palatal	Velar	Glottal
Stop	p	t	c	k	ʔ
Fricative		s			
Sonorant	m	r, l			

Only the rhotic /r/ may appear as the second consonant in a consonant cluster, and only after bilabial and velar stops. Syllable-initial consonant clusters permissible in Eastern Lawa are /pr, pʰr, ᵐbr, kr, kʰr, ᵑgr/. Within these clusters, the otherwise contrastive liquids [r] and [l], as in /ɾɛp/ ‘net’ and /lɛp/ ‘pile’, are in free variation. Both inter- and intra-speaker variation is found:

Intra-speaker variation:
Speaker 1: [kɾi ~ kli] ‘naughty’

Inter-speaker variation:
Speaker 1: [priᵃ] ‘alcohol’
Speaker 2: [pliᵃ] ‘alcohol’

The target /r/ is much more likely to be realized as a flap or trill when it follows an aspirated stop. 90% of words (26 out of 29 words) found with initial /pʰr/ or /kʰr/ were only ever realized as [pʰr] and [kʰr] respectively. Only three words in this study with aspirated clusters were found to occasionally be realized as [l]: /pʰɾɛ/ [pʰɾɛ ~ pʰlɛ] ‘hail’, /pʰɾajˀ/ [pʰɾajˀ ~ pʰlajˀ] ‘spicy’, and /kʰɾajˀ/ [kʰɾajˀ ~ kʰlajˀ] ‘to transport, carry’. The lateral tends to follow unaspirated or prenasalized stops. 79% of such words (30 out of 38) displayed a realization of [l] at least once.

When /r/ and /l/ appear as single onsets, their average duration in four randomly chosen words was 0.1052 seconds and 0.0952 seconds, respectively. However, when they appear as part of a consonant cluster, their average duration in four words is reduced by half, down to 0.0482 for [r] and 0.0480 for [l]. Thus, when the syllable gets larger, it appears that the language compensates by reducing the length of the extra consonant, thus reducing the increase in duration of the syllable as a whole. It is not known whether this is specific to Eastern Lawa, but a similar pheonomenon has been observed in Austroasiatic Muak Sa-aak, an Angkuic language (Hall, 2014). Vowel length is contrastive in Muak Sa-aak, and final sonorants are significantly lengthened following short vowels, with the result that all sonorant-final syllables have about the same length.

6 Summary and conclusion

The three existing phonological studies of Eastern Lawa in large part agree in their analysis of its consonants and monophthongs, but differ widely in their analysis of its diphthongs. The present reanalysis of Eastern Lawa reveals a series of implosive stops /ɓ, ɗ, ʄ/, whereas earlier studies posited a preglottalized stops or approximants /ˀb, ˀd, ˀj/ (Mitani, 1978; Lipsius, n.d.; Blok, 2013). The final consonant sequences /wh, wʔ/ (Blok, 2013; Mitani, 1978) and /yh, yʔ/ (Mitani, 1978) in previous analyses were reanalyzed as single phonemes, /w̥, wˀ, j̊, jˀ/ respectively. This study finds that all previous analyses of diphthongs were too complex, listing allophones that are conditioned by their environments. For example, [u] is predictably inserted between [e, ɛ] and final labials, [au] is an allophone of /aⁱ/, and [i] is predictably inserted before final palatals. Thus, all diphthongs and triphthongs ending in [u] or [i] could be eliminated, and only six remained: /iᵃ, iᵊ, ɨᵃ, aⁱ, uᵃ, uᵊ/. Excluding allophonic variation from this reanalysis allows for a simpler maximal syllable template, C(C)V(C).

Eastern Lawa words of one morpheme may be monosyllabic or disyllabic; these may then be combined to form compound words of up to five syllables. In disyllables, the first syllable is typically reduced. Eastern Lawa displays vowel insertion before final palatal and labial consonants and also shows an interesting distinction in pitch between nouns and verbs, although the language is not otherwise tonal. Further study is needed into this phenomenon. Such research on the linguistic varieties within Eastern Lawa might reveal different vowel structures and sets of diphthongs, which might then shed light on the vowel alternations and vowel shifts which have happened since Proto-Lawa times. Moreover, a lexical analysis would go far in revealing the degree of difference among all the varieties.

Eastern and Western Lawa have a more complex vowel system than other Waic languages. This system developed out of a previous register contrast in Proto-Wa-Lawa, which was itself derived from a more ancient contrast between voiced and voiceless initials. When the register contrast was lost after Proto-Wa-Lawa times, the vowel system developed a rich array of diphthongs instead. What is most notable is that Western Lawa has conservatively kept most of these, but Eastern Lawa has undergone a huge array of vowel shifts, which both slightly simplified and completely reshaped the vowel system, with the result that Eastern and Western Lawa today differ sharply from each other (Mitani, 1978). One Eastern Lawa variety has been compared with three Western Lawa varieties (Mitani, 1978), but an in-depth phonological comparison of Eastern and Western Lawa which included all varieties would likely reveal their differences more clearly. It may be worthwhile to include a lexical comparison, since Mitani's (1978) findings suggest that the main difference between Eastern and Western Lawa lies not in their phoneme inventory, but in their phonotactics and lexicon.

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Appendix 1: Eastern Lawa lexicon

Vowels – selected examples in varying environments

Monophthongs

/i/	/tiŋ/ [tiŋ]	navel
	/kih/ [kih]	salt
	/ⁿdi/ [ⁿdi]	to buy
	/s.piʔ/ [sᵩ.piʔ]	sweetcorn
	/jip/ [jip]	to winnow
/e/	/pew/ [pew]	to fly
	/te/ [te]	arrow
	/ᵐbrem/ [ᵐbrɐum]	noon
	/seʔ/ [seʔ]	head lice
	/reh/ [reh]	spider
/ɛ/	/pɛ/ [pɛ]	mango
	/ᵐbɛŋ/ [ᵐbɛiŋ]	mud
	/nɛm/ [nɛum]	year
	/rɛh/ [rɛh]	root

	/lɛc/ [lɛic]	pig
/ɨ/	/cɨk/ [cɨk]	rice paddy
	/kɨt/ [kɨt]	to think (>Thai)
	/dɨŋ/ [dɨŋ]	long
	/rɨʔ/ [rɨʔ]	big
	/jɨŋ/ [jɨŋ]	to pull
/ə/	/tʰək/ [tʰək]	to spit
	/də̀ŋ/ [də̀ŋ]	horn
	/ᵐbrək/ [ᵐbrək]	chili pepper
	/ʔmək/ [ʔmək]	to cough
	/s.ʔəŋ/ [sə̰.ʔəŋ]	snake
/a/	/taj̊/ [taj̊]	mushroom
	/kat/ [kat]	thorn
	/m̥ac/ [m̥aic]	sand
	/s.paw/ [sə.paw]	lime (for betel)
	/l̥aʔ/ [l̥aʔ]	leaf
/u/	/puj/ [puj]	person
	/tu/ [tu]	intestines
	/ʃuc/ [ʃuic]	drunk
	/ɲuʔ/ [ɲuʔ]	to push
	/jum/ [jum]	to die
/o/	/poŋ/ [poŋ]	bamboo shoot
	/ᵐbrok/ [ᵐbrok]	elephant tusk
	/ɲoʔ/ [ɲoʔ]	to drink
	/soc/ [soic]	to whistle
	/roh/ [roh]	to bark
/ɔ/	/dɔ̀j̊/ [dɔ̀j̊]	finger
	/ᵑgɔ/ [ᵑgɔ]	back (of body)
	/nɔŋ/ [nɔŋ]	seed
	/hɔk/ [hɔk]	to dry
	/l̥ɔʔ/ [l̥ɔʔ]	bark (n.)
/ɒ/	/tɒm/ [tɒm]	egg
	/kɒ/ [kɒ]	strong
	/dɒŋ/ [dɒŋ]	bamboo pole, pillar
	/mɒk/ [mɒk]	to kill
	/sɒʔ/ [sɒʔ]	dog

Diphthongs

/iᵊ/	/tiᵊ/ [tiᵊ]	flower
	/ʔiᵊn/ [ʔiᵊn]	uncle (father's younger brother)
	/ⁿdiᵊm/ [ⁿdiᵊm]	short (height)
	/ɲiᵊŋ/ [ŋiᵊŋ]	spider web
	/liᵊk/ [liᵊk]	to enter
/iᵃ/	/tiᵃʔ/ [tiᵃʔ]	small
	/ciᵃn/ [ciᵃn]	heavy
	/ʔiᵃh/ [ʔiᵃh]	to want, take
	/kʰriᵃ/ [kʰriᵃ]	gold
	/wiᵃk/ [wiᵃk]	stomach
/ɨᵃ/	/tɨᵃk/ [tɨᵃk]	palm (of hand)
	/kɨᵃŋ/ [kɨᵃŋ]	mouse
	/ɲɨᵃh/ [ɲɨᵃh]	to smile
	/fɨᵃʔ/ [fɨᵃʔ]	monkey
	/jɨᵃm/ [jɨᵃm]	to cry
/aⁱ/	/praⁱm/ [plaum]	terrestrial leech
	/kaⁱ/ [kaⁱ]	wind
	/maⁱh/ [maⁱh]	nose
	/haⁱk/ [haⁱk]	hair
	/raⁱŋ/ [raⁱŋ]	termite
/uᵊ/	/tuᵊn/ [tuᵊn]	cricket
	/kuᵊn/ [kuᵊn]	child
	/pʰruᵊk/ [pʰruᵊk]	rib
	/ᵐbruᵊt/ [ᵐbruᵊt]	to swallow
	/ŋuᵊt/ [ŋuᵊt]	brook, stream
/uᵃ/	/ʔuᵃt/ [ʔuᵃt]	to listen
	/pʰuᵃn/ [pʰuᵃn]	five
	/ʃuᵃŋ/ [ʃuᵃŋ]	village
	/suᵃk/ [suᵃk]	ear
	/huᵃ/ [huᵃ]	to vomit

Consonants – full lexicon

Stops

/p/	/p.tiᵊt/	to jump
	/p.dìᵃ/	now
	/p.ho/	pumpkin
	/p.ɲat/	disease
	/p.m̥ew/	friend

/pi.puᵃn/	food
/pi.pɾiᵊ/	teenage young man, boyfriend
/pi.cɨŋ/	tailor, seamstress
/pi.cɔh/	domestic servant
/pi.kuᵊt/	old person
/pi.kuᵊt.pi.sɔŋ/	elder, more senior person
/pi.kɾa/	hunter
/pi.ʔ.pəŋ/	woman
/pi.ʔ.sun/	ingredients
/pi.ʔ.majˀ/	man, male
/pi.cʰoʔ.toʔ/	butcher
/pi.cʰɔŋ/	goods to sell
/pi.kʰɾeh/	teenage young woman, girlfriend
/pi.s.ⁿdajˀ.ɲɨᵃʔ/	neighbor
/pi.hew.ⁿduᵃ/	messenger
/pi.how/	spare, leftovers
/pi.mɒk.toʔ/	butcher
/pi.nɛm/	truth
/pi.ɾɨʔ/	adult
/pi.juh.cɨk/	farmer
/pi.jum/	corpse
/pit/	pencil
/piʔ.ɗuᵃk/	forest
/pe/	to pack (>Thai)
/pep/	to break, snap
/pew/	to fly
/pe̯w/	to throw away
/pɛ/	mango
/pɛʔ/	goat (>Thai)
/pɛn.tʰɔ/	who
/pɛn.mɨᵃ/	sometimes (>Thai)
/pɨ̊j.kʰɒʔ/	sap
/pəŋ/	to shoot
/pap/	notebook (>Thai)
/pak.ʔah/	to stutter
/pak.ŋɔ/	earthworm
/paɲ/	to grab, hold
/paŋ/	bottle
/pajˀ/	you (2sg)
/pu/	thick
/pu.wa/	to shout, cry out
/puk/	to tie (>Thai)
/pun.pɛh/	to win
/puj/	person, human being

	/puj.ᵑgom/	hunchback
	/puj.haɲ/	other person
	/puj.mɔ/	hill tribe person, mountain dweller
	/puj.ɾɨʔ/	adult
	/puj.ɾɔŋ/	first person
	/poʔ/	together
	/poh/	to thresh rice
	/poh.kʰuᵃ/	to wash clothes
	/poŋ/	bamboo shoot
	/pɔ/	to request, ask for
	/pɔk/	to seek
	/pɔŋ/	stairs
	/pɔwˀ/	uncle (mother or father's younger brother)
	/pɒ/	to roll
	/pɒŋ/	window
	/piᵃn/	result (>Thai)
	/piᵃn.tʰam/	just, fair (>Thai)
	/piᵃŋ/	expensive (>Thai)
	/piᵃwˀ/	intestinal worm
	/piᵊŋ/	tooth
	/piᵊŋ.ᵑgap/	molar tooth
	/pɨᵃʔ/	father
	/pɨᵃʔ.s.ŋajˀ/	hornet
	/pɨᵃh/	bright
	/pɨᵃŋ.ŋɔŋ/	knee
	/paⁱk.hak.cuᵃŋ/	to take shoes off
	/paⁱŋ/	four
	/puᵃn/	to eat
	/puᵃŋ/	basket (for rice)
	/pɾeʔ/	fruit
	/pɾeh/	spear
	/pɾɛ/	to translate (>Thai)
	/pɾɛ/	beam of wood
	/pɾaɲ/	famine
	/pɾuk.pɾiᵃk/	lightning
	/pɾɒm/	fake, artificial (>Thai)
	/pɾiᵃ/	alcohol
	/pɾaⁱm/	terrestrial leech
/t/	/t.kɾaⁱ/	to fall over
	/t.faŋ/	riverbank (>Thai)
	/t.laj/	plate
	/t.laj.pɔm/	soup bowl
	/t.laj.ɓiᵊn/	plate (>Thai)

/ti.taj^{ʔ}/	short (time)
/ti.m̥a^{ɨ}ŋ/	ten thousand
/tik.tik/	gradually (>Thai)
/tiʔ.pɨ^{a}n/	one thousand (>Thai)
/tiʔ.ku/	pair (>Thai)
/tiʔ.k^{h}ap/	meal
/tiŋ/	navel
/tiŋ/	uncle, aunt (mother or father's older sibling)
/te/	arrow
/tep/	hut in rice field for resting in
/teʔ/	one
/tew/	not
/tej̊/	to kick
/tɛ/	sweet
/tɛk/	rape
/tɛm/	to boil (>Thai?)
/tɛm.p^{h}i^{a}/	late
/təɲ/	wall
/ta.hɨ^{a}/	harbor (>Thai)
/ta.jɨ^{a}ʔ/	ancestor
/ta.la.hut/	bald
/tak/	tongue
/taʔ/	grandfather (paternal)
/taʔ.kɛ/	chief, headman (>Thai)
/tam/	crab
/taɲ/	to remember
/taɲ.kɔk/	to weave
/taŋ.ʔi/	chair (>Thai)
/taŋ.ʔək/	all, whole (>Thai)
/taŋ.ɲɨ^{a}ʔ/	family (>Thai)
/taw/	lips
/taj̊/	mushroom
/taj^{ʔ}/	hand, arm
/taj^{ʔ}/	soil, earth
/taj^{ʔ}.ɲi^{ə}ŋ/	clay
/tu/	intestines
/tuk.ɲak/	to suffer (>Thai)
/tuʔ.cu^{a}ŋ/	calf (of leg)
/tum/	ripe
/tum.ʔ.saj̊/	rash
/tum.s.k^{h}ɾak/	rash
/tuŋ.kɐ/	chameleon
/tuŋ.ʔɛk/	dragonfly
/tuŋ.t^{h}ɔj/	pendant

	/tuj/	fat (person) (>Thai)
	/to/	shallow
	/toʔ/	hole
	/toʔ/	meat
	/toʔ.caʔ/	stove
	/toʔ.kɾiᵊk/	armpit
	/toʔ.s.ŋa/	curry
	/toʔ.maʲh/	nostril
	/toʔ.kʰɾaʔ/	path
	/tom/	floor
	/tɔ/	pipe (>Thai)
	/tɔ.l̥at/	to scare, frighten
	/tɔk.s.tɔŋ/	shrimp
	/tɔʔ.cɔŋ/	corner
	/tɔʔ.kɔk/	scorpion
	/tɔʔ.kɾɔŋ/	stream, river (>Thai)
	/tɔʔ.ɗen/	courtyard
	/tɔʔ.ŋuᵊt/	brook, stream
	/tɔm/	liver
	/tɔŋ/	metal cooking pot
	/tɔ̊j/	to cut off branches
	/tɒ/	to run
	/tɒ/	to flee, escape
	/tɒm/	to order (something)
	/tɒm/	egg
	/tɒm/	room
	/tɒŋ/	burnt (food)
	/tiᵃ/	sarong
	/tiᵃʔ/	small
	/tiᵊ/	flower
	/tiᵊp/	flea
	/tiᵊn/	candle (>Thai)
	/tɨᵃ/	duck
	/tɨᵃ/	bored
	/tɨᵃk.tajˀ/	palm of hand
	/tɨᵃʔ/	to pour over
	/tɨᵃʔ/	to sow
	/tɨᵃŋ/	to cross
	/taʲk.haʲk/	to pluck
	/tuᵊt/	to suck (>Thai)
	/tuᵊn/	cricket
/c/	/c.caʔ/	ghost
	/cep/	to meet

	/ceh/	to melt
	/ceh.cuᵃ/	weak
	/ceh.ʔmɛ/	saliva
	/cew/	heel
	/cɛ/	to soak, ferment (>Thai)
	/cɛʔ/	wet (>Thai)
	/cɨk/	rice paddy
	/cɨŋ/	to sew
	/c.ɾaj/	angry
	/cak/	deer
	/cak/	blind
	/caʔ/	ashes
	/caj̊/	to scratch (of a dog)
	/cut.wu/	mist, fog
	/coŋ/	to stand
	/cɔ/	slow
	/cɔk/	glass, cup
	/cɔn/	poor
	/cɔŋ/	bed
	/cɔjʔ.ciᵊ/	song
	/ciᵃ/	to pay
	/ciᵃp/	to wink
	/ciᵊk/	small frog
	/ciᵊn/	heavy
	/cɨᵃk/	brother-in-law (younger)
	/cuᵃ/	boss, leader (>Thai)
	/cuᵃŋ/	leg, foot
	/cuᵃŋ/	times (frequency)
	/cuᵃŋ.m.lɔŋ/	horizon
	/cuᵃŋ.l.suᵃk/	earlobe
/k/	/k.pɔŋ/	balcony
	/k.cɛ/	key (>Thai)
	/k.ʔew̥/	yesterday
	/k.tʰaŋ/	bucket, pail
	/k.ᵐbɾah/	half
	/k.ⁿdoʔ/	how many
	/k.ⁿdoʔ/	child (young)
	/k.ⁿdoʔ.ʔ.pəŋ/	girl
	/k.ⁿdoʔ.ʔ.majʔ/	boy
	/kip.tiᵊ/	petal (>Thai)
	/kih/	salt
	/keh/	to give birth
	/kem/	hut (for storage)

/keʷ̥/	to cook (rice), to steam
/kɛ/	cucumber
/kɛh/	able
/kɨt/	quail
/kɨt/	to be born (>Thai)
/kɨt/	to think (>Thai)
/kəŋ/	female (animal)
/kəj/	ever (>Thai)
/ka/	rice seedling (>Thai)
/ka.ɗuᵃŋ/	north, above
/ka.ⁿgɾaⁱm/	underneath
/ka.saj̊/	south, below
/ka.hej/	here
/ka.na/	front (>Thai)
/ka.naj/	inside (>Thai)
/ka.nok/	outside (>Thai)
/ka.nom/	where
/kat/	thorn
/kak.kʰoʔ/	stick, branch
/kaʔ/	fish
/kah/	to grill
/kah/	to untie, unwrap
/kam/	rice husk
/kam.pʰɾək/	wing, fin
/kam.joŋ/	knowledge (>Thai)
/kaɲ/	head
/kaɲ.pʰaⁱm/	heart
/kaw/	to sprout
/kaʷ̥/	porcupine
/kaj/	to have
/kok/	to eat
/koʔ.paʔ/	you (2sg)
/kɔk/	to call
/kɔŋ/	to heap up, pile up (>Thai)
/kom/	lamp (>Thai)
/kɒ/	hard, strong
/kiᵃw/	glass (>Thai)
/kiᵊt/	to bite (>Thai)
/kiᵊn.haⁱk/	to braid hair
/kɨᵃh/	to give
/kɨᵃh/	to wrap
/kɨᵃŋ/	mouse
/kaⁱ/	wind
/kaⁱk/	hot

	/kuᵃ/	ten
	/kuᵃ.ɾa.teʔ/	eleven
	/kuᵃt/	cold
	/kuᵃk/	to beckon with the hand
	/kuᵃŋ/	to dig
	/kuᵊt/	old (person)
	/kuᵊt.ʔiᵃh/	to want
	/kuᵊn/	child (of parents)
	/kuᵊn.tiŋ.kuᵊn.ʔiᵊn/	cousin, nephew or niece
	/kuᵊn.taw/	orphan
	/kuᵊn.caŋ/	illegitimate child
	/kuᵊn.kɾoŋ/	tadpole
	/kuᵊn.pʰa/	son-in-law
	/kuᵊn.soʔ.ʔ.pəŋ/	granddaughter
	/kuᵊn.soʔ.ʔ.majˀ/	grandson
	/kuᵊn.məŋ/	daughter-in-law
	/kuᵊn.ɾɔŋ/	firstborn child
	/kuᵊn.lec/	piglet
	/kɾi/	naughty
	/kɾa/	to hunt
	/kɾac/	fast
	/kɾajˀ/	lazy
	/kɾajˀ.joʔ/	to hate
	/kɾiᵃh/	to stir
	/kɾɨᵃk/	to lick
/ʔ/	/ʔ.peʔ/	shirt
	/ʔ.peʔ.juᵊt/	T-shirt (>Thai)
	/ʔ.pəŋ/	female (human)
	/ʔ.paw/	shadow
	/ʔ.pum/	fence
	/ʔ.poʔ/	soul
	/ʔ.poj.saŋ/	the trunk of an elephant
	/ʔ.pɔh/	scab, scale
	/ʔ.piᵃp/	seam
	/ʔ.paⁱk/	bridge
	/ʔ.paⁱŋ/	to bury (a corpse)
	/ʔ.prɔ̊j/	to shiver, tremble
	/ʔ.tit/	week (>Thai)
	/ʔ.tɨᵃk.cuᵃŋ/	sole of the foot
	/ʔ.tɨᵃh/	to turn over
	/ʔ.tɨᵃh/	to return (to a place)
	/ʔ.cɛ/	to argue
	/ʔ.kak/	twin

/ʔ.kaw/	dust
/ʔ.kɨᵃ/	to begin
/ʔ.kɨᵃʔ/	skinny
/ʔ.kʰu/	to roar
/ʔ.kʰɔt.ʔ.kʰɛt/	curly (hair)
/ʔ.ɓok/	pole (to put washing on)
/ʔ.ɓok/	to hang up to dry
/ʔ.ɗak.poŋ/	step (of stairs)
/ʔ.ɗoʔ/	to stop (work)
/ʔ.ᵐbɔm/	mouth
/ʔ.ᵐbɔm.saŋ/	beak
/ʔ.ᵐbuᵊt/	tear (n, when crying)
/ʔ.ⁿdɨᵃp/	to cover
/ʔ.ⁿdɨᵃp/	lid
/ʔ.ᵑgah/	to split open
/ʔ.ᵑgaⁱk/	to comfort
/ʔ.ᵑgɾaŋ/	to startle, surprise
/ʔ.ᵑgɾɔk/	to divide in half
/ʔ.sac/	to wash
/ʔ.sɔŋ.ɗɔ̰j̰/	knuckle
/ʔ.siᵊʔ/	few, little
/ʔ.majˀ/	sugarcane
/ʔ.majˀ/	male (human)
/ʔ.moʔ/	to dream
/ʔ.mo̰j̰/	banana
/ʔ.maⁱk/	cemetery
/ʔ.ɲe.piᵃŋ/	gums
/ʔ.ŋe.cuᵃŋ/	ankle
/ʔ.ŋoʔ/	dwarf honeybee
/ʔ.wiᵃ/	tiger
/ʔ.wɨᵃʔ/	door
/ʔ.wɨᵃŋ/	thigh
/ʔ.jɨt/	bellows
/ʔ.juᵃ/	gibbon
/ʔ.leh/	seven
/ʔ.liᵃŋ/	flour
/ʔ.liᵃŋ/	dessert, snack
/ʔek/	taro
/ʔeʔ/	we (1PL)
/ʔɛ/	chicken
/ʔɛ.kəŋ/	hen
/ʔɛ.mo̰ŋ/	rooster
/ʔɛŋ/	to come, return
/ʔəŋ/	it (3SG nonhuman pronoun)

	/ʔac/	sleep
	/ʔak/	crossbow
	/ʔak.ʔɔ/	Adam's apple
	/ʔaʔ.ɓɔk/	crooked
	/ʔaʔ.joh/	earthquake
	/ʔah/	to talk, speak
	/ʔah/	landslide
	/ʔaɲ/	hornet
	/ʔaɲ/	raw
	/ʔaɲ/	alive
	/ʔajˀ/	I (1sg)
	/ʔuŋ/	drinking water container
	/ʔuŋ.ʔuj/	to swing
	/ʔok/	chest (>Thai)
	/ʔoj̊/	swollen
	/ʔɔp/	food allergy
	/ʔɔk/	to exit, go out (>Thai)
	/ʔɔʔ/	bamboo
	/ʔɔj/	sister-in-law (older)
	/ʔiᵃh/	to want, take
	/ʔiᵊk/	brother-in-law (older)
	/ʔiᵊk.puʔ/	relative
	/ʔiᵊn/	uncle (father's younger brother)
	/ʔiᵊŋ/	excrement
	/ʔaⁱk/	to be, live (in a place)
	/ʔaⁱp.pu/	evening meal
	/ʔaⁱp.saʔ/	breakfast
	/ʔaⁱp.nɛm/	cooked rice
	/ʔaⁱp.ŋajˀ/	lunch
	/ʔaⁱp.niᵊŋ/	pounded rice
	/ʔuᵃʔ/	mute
	/ʔuᵃt/	to listen
	/ʔuᵃn/	some
	/ʔuᵊt/	to wipe
	/ʔuᵊʔ/	senile
/pʰ/	/pʰ.sa/	language (>Thai)
	/pʰ.mat/	to insult, offend
	/pʰɛʔ/	forest
	/pʰuʔ.tɔŋ/	baby sling
	/pʰoʔ/	to spill
	/pʰɔʔ/	cooking stones
	/pʰiᵊ/	to spin thread
	/pʰuᵃh/	to blow

	/pʰuᵃh/	to winnow
	/pʰuᵃn/	five
	/pʰuᵃŋ/	steam (n.)
	/pʰɾɛ/	hail
	/pʰɾaŋ/	old (thing)
	/pʰɾaŋ/	roof
	/pʰɾajˀ/	spicy, hot
	/pʰɾu.tɑŋ/	loincloth
	/pʰɾuʔ/	blanket
	/pʰɾɨᵃ/	coconut
	/pʰɾaⁱp/	urgent
/tʰ/	/tʰɛp/	cheap
	/tʰək/	to spit
	/tʰəŋ/	ceiling
	/tʰɔ/	that
	/tʰɔj/	cup, mug (>Thai)
	/tʰɔj/	bowl (>Thai)
	/tʰiᵃw/	row, line (>Thai)
	/tʰuᵃ.dîn/	peanut (>Thai)
	/tʰuᵃt/	to deep-fry (>Thai)
/cʰ/	/cʰ.moŋ/	hour (>Thai)
	/cʰoʔ/	to sell
	/cʰɔʔ/	to stop up, plug up
	/cʰiᵃw/	to sharpen
	/cʰuᵃŋ/	light (weight)
/kʰ/	/kʰi.tə/	phlegm (>Thai)
	/kʰi.tʰɔj/	dirty (>Thai)
	/kʰeʔ/	firewood
	/kʰeʔ/	moon, month
	/kʰeʔ.kʰɾaʔ/	street, road
	/kʰaŋ/	bile, gall
	/kʰaŋ.kʰajˀ/	back, behind
	/kʰuʔ.ŋoŋ/	to kneel
	/kʰum.pi.jum/	grave
	/kʰoʔ.ʔ.tɔh/	pestle
	/kʰɔk/	prison (>Thai)
	/kʰɒʔ/	tree
	/kʰɒʔ.piᵊn/	board, plank
	/kʰɒʔ.ʔ.kʰiᵊŋ/	cuttingboard (>Thai)
	/kʰɒʔ.pʰɾɨᵃ/	coconut tree
	/kʰɒʔ.ᵑgeʔ/	cane, walking stick

	/kʰiᵊp/	narrow (>Thai)
	/kʰɾiŋ/	disgusting
	/kʰɾeʔ/	splinter
	/kʰɾeh/	bear
	/kʰɾɛ/	to cut (branches), prune
	/kʰɾəŋ/	every
	/kʰɾəŋ/	to speak
	/kʰɾəŋ.toʔ/	everywhere
	/kʰɾa/	slave
	/kʰɾak/	buffalo
	/kʰɾaʔ.cuᵃŋ/	footpath
	/kʰɾaŋ/	drum
	/kʰɾajˀ/	to transport, carry
	/kʰɾum/	soybean
	/kʰɾoʔ/	new
	/kʰɾoŋ/	crunchy
	/kʰɾɔ/	kapok
	/kʰɾɔŋ/	slit
	/kʰɾɒʔ/	enough
	/kʰɾɒŋ/	handle
	/kʰɾiᵃ/	gold
	/kʰɾiᵃh/	to disappear
/ɓ/	/ɓet/	to fish
	/ɓeŋ/	to hit
	/ɓeŋ.hɔʔ/	to thresh rice
	/ɓew/	round
	/ɓək/	mortar
	/ɓak.ɓɨᵃh/	intestinal worm
	/ɓak.ɓuᵊn/	middle
	/ɓot/	overcast
	/ɓiᵊk/	to chop (meat)
	/ɓɨᵃʔ/	to break
/ɗ/	/ɗìn.ci/	brick (>Thai)
	/ɗɔʔ/	deep
	/ɗɛ/	forehead
	/ɗɛŋ/	long (time)
	/ɗɨŋ/	long
	/ɗək/	rafter
	/ɗəŋ/	horn
	/ɗop/	rattan
	/ɗɔ/	to tell
	/ɗɔ.laŋ/	to command, order

	/ɗɔ̰j/	finger
	/ɗɔ̰j.kəŋ.cuᵃŋ/	big toe
	/ɗɔ̰j.kiᵊn/	little finger, little toe
	/ɗɔk.ʔɨᵃŋ/	orchid (>Thai)
	/ɗɔ̰j.ɓak.ɓuᵊn/	middle finger
	/ɗɔ̰j.n̪aŋ/	ring finger
	/ɗɔ̰j.ɾɔ/	index finger
	/ɗɔ̰j.luᵃn/	noisy, loud
	/ɗɒŋ/	bamboo pole, pillar
	/ɗiᵃ/	squirrel
	/ɗiᵊn/	to work hard
/ʃ/	/ʃɨt/	to extinguish
	/ʃaŋ/	plastic (>Thai)
	/ʃuc/	drunk
	/ʃɨᵃ/	opium, narcotic drug (>Thai)
	/ʃɨᵃ/	medicine (>Thai)
	/ʃɨᵃ/	easy
	/ʃɨᵃ.ɓɨᵃ/	poison (>Thai)
	/ʃɨᵃt/	stretchy (>Thai)
	/ʃɨᵃʔ/	grandmother (paternal) (>Thai)
	/ʔjɨᵃʔ.kɛ/	herb (>Thai)
	/ʃuᵃŋ/	village
	/ʃuᵊt/	to drip
/ᵐɓ/	/ᵐbɛŋ/	mud
	/ᵐbuŋ.ᵐbaŋ/	butterfly
	/ᵐbuŋ.ᵐbaŋ.ma.saⁱm/	moth
	/ᵐboʔ/	to fill
	/ᵐboh/	young
	/ᵐbiᵃ.ʔaⁱm/	cloud
	/ᵐbiᵊ/	to forget
	/ᵐbuᵃk/	to stab
	/ᵐbuᵊt.ʔak/	wasp
	/ᵐbɾem/	noon
	/ᵐbɾɛ/	bracelet
	/ᵐbɾɛʔ/	straw, hay
	/ᵐbɾək/	chili pepper
	/ᵐbɾək/	to swallow
	/ᵐbɾak/	bat
	/ᵐbɾak/	lead (metal)
	/ᵐbɾaʔ/	to steal
	/ᵐbɾok/	elephant tusk
	/ᵐbɾoʔ/	to lie, deceive

	/ᵐbɾɔh/	to pound
	/ᵐbɾɔŋ/	horse
	/ᵐbɾɔŋ/	mole
	/ᵐbɾuᵊt/	to swallow
/ⁿd/	/ⁿdi/	to buy
	/ⁿdɛ/	horsefly
	/ⁿda/	freshwater leech
	/ⁿda.ʔ.ɗàh/	to quarrel, fight
	/ⁿdah/	to slap
	/ⁿdaŋ/	pot (for cooking)
	/ⁿdiᵊm/	short (height)
/ᵑg/	/ᵑgi.kaŋ/	dizzy
	/ᵑgeʔ/	pine kindling
	/ᵑgɛh/	afternoon
	/ᵑgap/	chin or jaw
	/ᵑgaʔ/	empty
	/ᵑgawˀ/	to fall over
	/ᵑgom/	hump (of hunchback)
	/ᵑgoŋ/	bridge of the nose
	/ᵑgoŋ.cuᵃŋ/	shin
	/ᵑgɔ/	back (of body)
	/ᵑgiᵃ/	to chew
	/ᵑgiᵃŋ/	pregnant
	/ᵑgiᵊp.ʔ.wɨᵃŋ/	groin
	/ᵑgɾeŋ/	leprosy, scabies
	/ᵑgɾam/	garbage, waste
	/ᵑgɾaŋ/	convenient
	/ᵑgɾoʔ/	ditch
	/ᵑgɾiᵊk/	maggot

Fricatives

/f/	/faj/	canal
	/fiᵊk/	dark
	/fɨᵃʔ/	monkey
	/fuᵃn/	to dance (>Thai)
/s/	/s.piʔ/	sweetcorn
	/s.paʔ/	cheek
	/s.paw/	cement
	/s.paw/	lime (for chewing betel)
	/s.puj/	eggplant
	/s.teʔ/	day after tomorrow
	/s.taʔ/	tail

/s.taɲ/	nine
/s.tajˀ/	eight
/s.tuʔ/	monk
/s.tɔk/	to teach
/s.tɔŋ.kaɲ/	brain
/s.kɛɲ/	ginger
/s.ʔeh/	tomorrow
/s.ʔew/	warm
/s.ʔəŋ/	snake
/s.ʔəŋ.ŋew.piŋ/	cobra
/s.ʔaŋ/	bone
/s.ʔaŋ.kaɲ/	skull
/s.ʔaŋ.pʰɾuᵊk/	rib
/s.ʔaŋ.ᵑgɔ/	backbone, spine
/s.ʔum/	rotten
/s.ʔɔh/	dry
/s.ʔɔh.s.ʔoɲ/	drought
/s.pʰɾajˀ/	to look after
/s.kʰa/	comb
/s.ɓəŋ/	star
/s.ⁿdajˀ/	near
/s.ⁿdɒw̰/	to stumble
/s.ᵑgɾa/	gecko
/s.ma/	to plant
/s.mak/	gill
/s.moʔ/	stone
/s.moʔ.mo/	grinding stone
/s.nat/	gun (>Thai)
/s.nak/	tendon
/s.nuᵊn/	spoon
/s.nuᵊn.ɾɨʔ/	ladle
/s.ŋajˀ/	sun
/s.ŋajˀ/	day
/s.ŋiᵃ/	far away
/s.ˀŋaʔ/	clean
/s.ɾa/	craftsman
/s.wiᵊt/	to squeeze, wring out
/s.wuᵃk/	shoulder
/s.li/	bed
/s.lɔŋ.ˀŋiᵃ/	pupil of the eye
/si.piŋ/	white
/si.s.kʰɾak/	red
/si.s.ŋej/	yellow
/si.s.ŋa/	green

/si.lɔŋ/	black
/seʔ/	head lice
/sɛʔ/	basket (for clothes)
/sɛh.kʰeʔ/	to split wood
/sɛn/	line (>Thai)
/sɛn.koŋ/	bend, curve (>Thai)
/sɛŋ/	light (>Thai)
/sə/	straight
/səʔ.tiᵃk/	two days after tomorrow
/sat/	mat
/sat.haⁱk/	to comb hair
/sak/	full (of food)
/sak.mɨk/	tattoo (>Thai)
/saʔ.tʰu/	enemy (>Thai)
/sam/	future tense
/sam.ʔoj̊/	to swell
/saɲ/	bird
/saɲ/	cooked
/saɲ.ka.kɛ/	dove
/saɲ.ʃuᵃŋ/	sparrow
/saŋ/	elephant
/saŋ.man/	when
/saj.soj/	necklace (>Thai)
/so.ŋaʔ/	to itch
/soʔ/	sick
/soʔ/	rainbow
/soʔ/	painful
/soʔ.kik/	shy
/soʔ.maɲ/	tired
/soʔ.kaɲ/	headache
/soc/	to whistle
/som/	to eat rice
/soŋ.ʃaŋ/	plastic bag (>Thai)
/soj/	to cut, slice
/sɔ.ko/	to wake someone up
/sɔk/	elbow (>Thai)
/sɔʔ.caw/	pain
/sɔʔ.kʰɾuᵃŋ/	sore throat
/sɔŋ/	bitter
/sɔŋ.k.ɗat/	paper bag (>Thai)
/sɔŋ.ʔ.wɨᵃʔ/	to shut the door
/sɔj̊/	charcoal, ember
/sɒʔ/	dog
/sɒh/	to cut long grass (with a scythe)

/h/	/hit/	coffin (>Thai)
	/him/	beside, next to (>Thai)
	/hew/	to go, walk
	/hew.kʰajˀ/	to follow
	/hej/	this
	/hɛ/	bee
	/həŋ/	many
	/ha/	mold
	/haʔ/	burnt
	/ha.ʔ.pʰaⁱm/	to breathe
	/hac/	to scratch (of a human)
	/hak/	skin, leather
	/hak.cuᵃŋ/	shoe
	/hak.ˀŋiᵃ/	eyelid
	/haɲ/	other
	/haw.ʃaŋ/	plastic bag (>Thai)
	/hot/	to splash (>Thai)
	/hoc/	to finish
	/hom/	shade (>Thai)
	/hom.pom/	coriander
	/hom.ᵐbiŋ/	garlic
	/hom.ɾaʔ/	onion (>Thai)
	/hɔk.s.ʔɔh/	to dry food
	/hɔj.lak.lɔʔ/	snail (>Thai)
	/hiˢŋ/	smart (>Thai)
	/hɨᵃ/	boat (>Thai)
	/haⁱk/	to arrive
	/haⁱk/	hair
	/haⁱk.kiˢn/	braid (hair)
	/haⁱk.ʔ.wuj/	eyebrow
	/haⁱk.ʔ.waⁱp/	beard
	/haⁱk.ʔ.jiˢp/	eyelash
	/haⁱk.sə/	straight hair
	/haⁱk.saɲ/	feather
	/haⁱm/	to bathe
	/huᵃ/	to vomit
	/huᵃk/	to climb

Nasals

/m/	/m.taw/	watermelon
	/m.ka/	pot
	/m.kuj.tɛt/	papaya (>Thai)
	/m.kʰaŋ/	pan

/m.nat/	pineapple
/m.ɾəŋ /	beginning, start
/m.ləŋ/	sky
/mit.ɲap/	scissors (>Thai)
/mep/	cow
/mep.ŋ̊aɲ/	bull
/mep.ləʔ/	ox cart
/meɲ/	to count
/meŋ/	insect (>Thai)
/mɛ.caŋ/	midwife (>Thai)
/mɛh/	again, more
/mɛh/	wedding
/mɛɲ/	pot (for storing water)
/ma.pu/	evening
/ma.saʔ/	morning
/ma.saʔ.ləŋ/	early morning
/ma.saⁱm/	night
/mac/	good, beautiful
/maʔ/	mother
/maʔ.kuᵊt/	grandmother (maternal)
/mah.man/	what
/mah.jaŋ.man/	how
/man/	what
/man.ʔ.lu/	potato (>Thai)
/maŋ.ʔuᵊn/	sweet potato
/maw/	to crawl
/mawˀ/	ring (finger)
/mu.koʔ.paʔ/	you (2pl) (>Thai)
/mu.tʰɔ/	they (3pl) (>Thai)
/mu.meʔ/	you (2pl) (>Thai)
/moʔ.hej/	only
/mut/	to sink (>Thai)
/muk/	balcony
/moɲ/	word
/moŋ/	gong
/mɔ/	mountain
/mɔ.ka/	kettle (>Thai)
/mɔŋ/	dull, dim
/mɔŋ/	to wait
/mɒk/	to kill
/mɒŋ/	pimple
/miᵃw/	cat (>Thai)
/maⁱ/	money, silver
/maⁱk/	ant

	/maʲh/	name
	/maʲh/	nose
	/muᵃn/	pillow (>Thai)
	/muˢn/	fun
	/muˢn.man/	how much
/n/	/nɛm/	to hatch
	/nɛm/	aunt (mother's younger sister)
	/nɛm/	year
	/nɛm/	true
	/nɛm.ᵐbɾeʔ/	thunder
	/nɛŋ/	breast
	/nək/	to choke
	/nəŋ/	bent, crooked
	/na/	face (>Thai)
	/na.kaʲk/	hot season (>Thai)
	/na.kuᵃt/	cool season (>Thai)
	/na.tʰi/	minute (>Thai)
	/na.l̥ajˀ.l̥ajˀ/	rainy season (>Thai)
	/nak.nəŋ/	jackfruit
	/naʔ.tɨᵃh/	buttocks
	/nam.ɓɔj/	coconutshell ladle
	/nam.nə/	tomato
	/najˀ/	meat, flesh
	/noʔ/	to store
	/nɔʔ/	to divorce
	/nɔŋ/	seed
	/nɔŋ.s.moʔ/	rock
	/nok.ɲuŋ/	peacock
	/niᵃn/	to look at
	/nɨᵃŋ/	frequent, often
	/naʲm/	to urinate
	/nuᵃŋ/	to harvest
/ɲ/	/ɲeʔ/	needle
	/ɲeʔ.ɲɨᵃʔ/	move house
	/ɲa.ɲiˢk/	ant
	/ɲap.haʲk/	to cut hair
	/ɲak/	giant (>Thai)
	/ɲak/	difficult (>Thai)
	/ɲaʔ/	place
	/ɲaʔ.ɲaʲm/	seat
	/ɲaŋ.ɾeh/	spider
	/ɲah.kʰuᵃ/	to wear clothes

	/ɲuʔ/	to push
	/ɲum/	tasty
	/ɲuŋ/	busy (>Thai)
	/ɲuŋ/	mosquito (>Thai)
	/ɲoʔ/	to drink
	/ɲom/	to dye (>Thai)
	/ɲoŋ/	lower back
	/ɲɔm/	to comply (>Thai)
	/ɲiˀŋ/	sticky
	/ɲiˀŋ.ɲaŋ.reh/	spider web
	/ɲiᵃʔ/	to marry
	/ɲiᵃʔ/	house
	/ɲiᵃʔ.kuˀn.taw/	orphanage
	/ɲiᵃʔ.saɲ/	bird's nest
	/ɲiᵃʔ.hɛ/	beehive
	/ɲiᵃh/	to smile, laugh
	/ɲaⁱm/	to sit
/ŋ/	/ŋɛ/	to groan (with pain)
	/ŋə/	lonely
	/ŋɔ /	fire
	/ŋɔ.kʰɾit/	matches
	/ŋɔk/	neck
	/ŋuᵃ/	stupid (>Thai)
/m̥/	/m̥ew/	to play together
	/m̥ək/	to catch
	/m̥ac/	sand
	/m̥aɲ/	male (animal)
	/m̥aɲ/	question
	/m̥aɲ/	fingernail
	/m̥ɔ.məŋ/	medicine man (>Thai)
	/m̥ɔ.miᵃ/	fortune teller (>Thai)
	/m̥ɒŋ/	to hear
	/m̥iᵃ/	slave
	/m̥aⁱŋ/	ten thousand
/n̥/	/n̥ew/	to snore
	/n̥am/	blood
	/n̥ɔŋ/	lake
/ŋ̊/	/ŋ̊ap/	to yawn
	/ŋ̊aw/	to smell nice
	/ŋ̊ɔʔ/	rice plant

	/ŋ̊aʲk/	to smell
/ˀm/	/ˀmaw/	hammer, axe
	/ˀmuj̊/	to sneeze
	/ˀmək/	to cough
	/ˀmoʔ/	string, rope
	/ˀmoʔ.hɛt/	strap
	/ˀmiᵃt/	to knead, squeeze
	/ˀmaʲk/	smoke
	/ˀmuᵃt/	to grind
/ˀn/	/ˀnɛm/	termite mound
	/ˀnaʔ/	sour
	/ˀnajˀ/	hat
	/ˀnɔŋ/	only, alone
/ˀŋ/	/ˀŋɛ/	to cut (in pieces)
	/ˀŋa/	twenty
	/ˀŋuj/	thirty
	/ˀŋiᵃ/	eye
	/ˀŋiˤŋ/	short (length)
Rhotic		
/ɾ/	/ɾ.pɒŋ/	forty
	/ɾɨt.kɾɔŋ/	custom
	/ɾɛp/	net
	/ɾɛɲ/	ant
	/ɾɛh/	root (of tree)
	/ɾɨʔ/	big
	/ɾɨʔ.pu.huᵃk/	to grow up
	/ɾac/	grass
	/ɾac.s.ʔɔh/	hay
	/ɾak/	to love (>Thai)
	/ɾaw/	to fall
	/ɾaw̥/	turtle
	/ɾoŋ.ŋɔ/	kitchen (>Thai)
	/ɾoh/	to bark
	/ɾoj/	housefly
	/ɾɔ/	to point at, indicate
	/ɾɔj̊/	to choose, pick
	/ɾiᵃh/	bad
	/ɾaʲŋ/	termite

Approximants

/w/	/wɛ/	trousers
	/wat/	to throw
	/wan.saⁱm/	late night
	/wiᵃk/	stomach, belly
	/wiᵃk/	to snap in two
	/wiᵊ/	to borrow
	/wiᵊn/	mirror
	/wɨᵃk.s.ʔac/	centipede
	/wɨᵃh/	wide, broad
	/wɨᵃh.ɾɨʔ/	spacious
/j/	/jip/	to winnow
	/jɨŋ/	to pull
	/jaŋ.suᵃk/	earwax
	/jaŋ.maⁱh/	mucus, snot
	/juh/	to do, make
	/juh.kan/	to work
	/juh.man/	why
	/jum/	to die
	/joʔ/	to see
	/joŋ/	to know
	/jiᵊp/	to blink
	/jɨᵃm/	to cry
	/juᵃk.huᵃk/	to lift up (>Thai)
/l/	/l.ʔa/	two
	/l.ʔak/	crow
	/l.ʔaŋ/	limestone
	/l.ʔaw̥/	oil, fat (cooking)
	/l.ʔaj̊/	today
	/l.ʔoj/	three
	/l.ʔaⁱk/	hot (weather)
	/l.ʔaⁱk/	sweat
	/l.ʔaⁱm/	water
	/l.ʔaⁱm.tip/	nectar
	/l.ʔaⁱm.tɛm/	boiled water (>Thai)
	/l.ʔaⁱm.tʰuᵊm/	flood (>Thai)
	/l.ʔaⁱm.kʰaŋ/	puddle
	/l.ʔaⁱm.hɛ/	honey
	/l.ʔaⁱm.nɛŋ/	milk
	/l.ʔaⁱm.ɲoʔ/	drinking water
	/l.ʔaⁱm.ˀmɛ/	saliva
	/l.ʔaⁱm.ˀmɔ/	well

	/l.ʔaⁱm.ɾaʔ/	river
	/l.suᵃk/	ear
	/l.haʔ/	to play
	/l.huᵃn/	fifty
	/l.ŋaʔ/	sesame
	/l.ŋɔ/	black sesame
	/l.wuj/	dusk
	/leh/	six
	/lɛ.liᵊŋ/	cockroach
	/lɛp/	pile
	/lɛc/	pig
	/lɛc.kəŋ/	sow
	/lɛc.pʰɾeʔ/	wild boar
	/lɛk/	to exchange (>Thai)
	/ləm/	to start (>Thai)
	/la.ka/	direction
	/la.ka.tɒm/	right side
	/la.ka.ʔɔk.s.ŋajˀ/	east (>Thai)
	/la.ka.ɾaw.s.ŋajˀ/	west (where the sun drops)
	/la.ka.weʔ/	left side
	/la.ka.liᵊk.s.ŋajˀ/	west (where the sun enters)
	/lam.ˀmak/	hardship, distress (>Thai)
	/lan/	earring
	/law/	goiter
	/lot.tʰip/	bicycle (>Thai)
	/lot.kʰɾiᵃŋ/	motorbike (>Thai)
	/lok.sɒʔ.wɒ/	rabies (>Thai)
	/lom/	loose, slack
	/lɔk/	correct
	/lɔm/	sharp
	/lɔŋ/	to float, flow
	/lɔŋ.niᵃn/	to try out (>Thai)
	/liᵃw/	eagle
	/liᵊk/	to enter
	/liᵊk.ʔ.pʰaⁱm/	to understand
	/liᵃm/	smooth
	/laⁱm/	bean
	/luᵃt/	straw (for drinking) (>Thai)
/l̥/	/l̥ec/	iron
	/l̥ej/	thin
	/l̥ɛm/	bruise
	/l̥at/	afraid
	/l̥aʔ.kʰoʔ/	leaf

/l̥aʔ.hɔm/	spring onion (>Thai)
/l̥ajˀ/	rain
/l̥ɔʔ/	bark (n.)
/l̥ɔŋ/	cool
/l̥ɒŋ/	quiet
/l̥iᵊn/	to learn, study (>Thai)
/l̥aⁱk/	deaf
/l̥aⁱŋ/	spoiled (of food)
/l̥uᵃŋ/	high, tall